DOCUMENT RESUME

ED 190 698 UD 020 780

AUTHOR Smith, Mary Lee; Glass, Gene V.
TITLE Relationship of Class-Size to Classroom Processes, Teacher Satisfaction and Pupil Affect: A Meta-Analysis.
INSTITUTION Far West Lab. for Educational Research and Development, San Francisco, Calif.
SPONS AGENCY National Inst. of Education (DHEW), Washington, D.C.
PUB DATE Jul 79
NOTE 81p.: For a related document see ED 168 129. Some pages may be marginally legible due to broken print.
AVAILABLE FROM Order Department, Far West Laboratory for Educational Research and Development, 1855 Folsom Street, San Francisco, CA 94103 ($5.50).

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Classroom Environment; *Class Size; Elementary Secondary Education; Higher Education; *Outcomes of Education; Statistical Analysis; *Statistical Studies; *Student Attitudes; Student Behavior; Student Teacher Ratio; *Teacher Attitudes

ABSTRACT

Using data from previously completed research, the authors of this report attempted to examine the relationship between class size and measures of outcomes such as student attitudes and behavior, classroom processes and learning environment, and teacher satisfaction. The authors report that statistical integration of the existing research indicated that reduction in class size is associated with higher quality schooling and more positive attitudes. The meta-analysis procedure used by the authors revealed that small class size is associated with higher quality classroom environments, better student attitudes, and greater teacher satisfaction. Findings also indicated that class size effects are related to pupil age, with effects most noticeable for children 12 years and under and least apparent for pupils 18 or over. Tables of data are included in the report. A technical explanation of integrrative analysis is appended. (Author/MK)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

THE CLASS SIZE AND INSTRUCTION PROJECT ☐ LEONARD S. CAHEN, PRINCIPAL INVESTIGATOR

APR 3 0 1980

ED190698

RELATIONSHIP OF CLASS-SIZE TO CLASSROOM PROCESSES, TEACHER SATISFACTION AND PUPIL AFFECT: A META-ANALYSIS

Mary Lee Smith
Gene V Glass

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

UD020780

FAR WEST LABORATORY FOR EDUCATIONAL RESEARCH AND DEVELOPMENT

The project presented or reported herein was performed pursuant to a grant from the National Institute of Education, Department of Health, Education, and Welfare. However, the opinions expressed herein do not necessarily reflect the position or policy of the National Institute of Education, the Department of Health, Education, and Welfare, or the Far West Laboratory for Educational Research and Development, and no official endorsement by these agencies should be inferred.

This work is being placed on sale, at cost, by Far West Laboratory for Educational Research and Development using its own funds. Copies may be purchased (prepaid) from:

Order Department
Far West Laboratory for Educational
Research and Development
1855 Folsom Street
San Francisco, CA 94103

Price: $5.50 (First Class: $7.00)

Payment must accompany order. California residents please add appropriate sales tax.

May be Reproduced Without Permission • Not Printed at Government Expense

The first meta-analysis, *Meta-Analysis of Research on the Relationship of Class-Size and Achievement* by Gene V Glass and Mary Lee Smith, is available through the Order Department of Far West Laboratory. The price (prepaid) is $5.50 (First Class: $7.00).

Complimentary reprints of the March 1979 Phi Delta Kappan article, *The Class Size/Achievement Issue: New Evidence and a Research Plan* by Leonard S. Cahen and Nikola N. Filby, are available by request. Write: Class Size and Instruction Project, 1855 Folsom Street, San Francisco, CA 94103.

RELATIONSHIP OF CLASS-SIZE TO CLASSROOM PROCESSES, TEACHER SATISFACTION AND PUPIL AFFECT: A META-ANALYSIS

Mary Lee Smith
Gene V Glass
Laboratory of Educational Research

July 1979

PREFACE TO SECOND META-ANALYSIS

This is the second in a series of reports to be published by the Class Size and Instruction Project, of the Far West Laboratory. The first report was the Meta-Analysis of Research on the Relationship of Class-Size and Achievement, also conducted by Drs. Gene V Glass and Mary Lee Smith of the University of Colorado. This report has received national and international attention and has provided positive evidence that reduced class size and greater pupil achievement are indeed associated.

The present report provides important information about the relationship of class size and the variables of classroom or instructional processes, teacher satisfaction, and pupil affect. Again, the authors' search through the literature has uncovered many studies that have not been examined in earlier investigations of class size. Again, evidence is presented about the positive impact of reduced class size.

The two reports confront educational decision-makers with reasonable evidence that reduced class size can have positive effects upon classroom processes and pupil learning. If this evidence is convincing, educators must find ways to reduce class size for at least parts of the school day and year. The question of resource allocation becomes crucial. On one hand, the country is faced with severe problems in the financing of education; and yet, on the other hand, this country has a long history of belief in the importance of quality instruction for pupils.

In the Fall of 1979, a series of reaction papers dealing with the policy implications of the two meta-analyses will be commissioned by the Class Size and Instruction Project. I hope that the reaction papers will provide additional interpretations of the two meta-analyses and will provide insights into their policy implications for improving education.

I again wish to thank my colleague, Dr. Nikola N. Filby, for her major contributions to the Project and for her consultation on the second meta-analysis. Drs. David C. Berliner and Richard M. Jaeger provided excellent critical reviews of an early version of the manuscript. I also wish to acknowledge the continual support of Joseph Vaughan and Virginia Koehler of the National Institute of Education.

Dr. Leonard S. Cahen
Principal Investigator
Class Size and Instruction Project
Far West Laboratory
1855 Folsom Street
San Francisco, CA 94103
July 20, 1979

SUMMARY

In earlier papers (Glass & Smith, 1978, 1979) we examined the relationship between class size and student achievement, through a statistical integration of existing research. Eighty studies were gathered, read, and their separate results translated into a common metric. When this metric was summarized, we demonstrated a substantial relationship between class size and achievement. As class size increases, achievement decreases.

This report extends the earlier work by examining the relationship between class size and other outcome measures, such as classroom processes and learning environment, student attitudes and behavior, and teacher satisfaction. These outcomes are valuable in their own right; to some people, even more valuable than achievement test scores. Examining multi-dimensional class-size effects also helps us understand how changes in class size influence student learning.

The effects of class size on classroom processes, pupil affect and teacher satisfaction are strong and consistent. On all measures, reduction in class size is associated with higher quality schooling and more positive attitudes. The class-size effects were related to age of pupils, with effects most notable for children 12 years and under, and least apparent for pupils 18 or over. Reducing class size has beneficial effects both on cognitive and affective outcomes and on the teaching process itself. These relationships have not in the past been apparent because of an inability to deal with either the class sizes or the effects precisely and quantitatively. Using meta-analysis permits us to unravel the complexity and reveal the effects of class-size.

Class size affects the quality of the classroom environment. In a smaller class there are more opportunities to adapt learning programs to the needs of individuals. Many teachers avail themselves of these opportunities; others would need training to do so. Chances are good that the climate is friendlier and more conducive to learning. Students are more directly and personally involved in learning.

Class size affects pupils' attitudes, either as a function of better performance or contributing to it. In smaller classes, pupils have more interest in learning. Perhaps there is less distraction. There seems to be less apathy, friction, and frustration.

Class size affects teachers. In smaller classes their morale is better; they like their pupils better, have time to plan and diversify, are more satisfied with their performance. Does this mean that class size is merely a selfish, political issue for teachers? Or is the happier teacher the one who performs better? This we cannot unravel, except to cite the other evidence--that the smaller the class is the greater is the effect on the instructional process, on pupil affect, and on achievement.

CLASS-SIZE AND NON-ACHIEVEMENT EFFECTS

INTRODUCTION

Among techniques designed to improve education, decreasing class size is the most controversial. Teachers have lauded the benefits of smaller classes. Administrators have demonstrated their high cost. Because of the costs of decreasing class size, policy-makers have demanded that it be justified on the basis of increased achievement.

Researchers have been unable to resolve the controversy by providing an unequivocal answer to the class size question. Many studies have been conducted: some showed that smaller classes were better, some showed that larger classes were better, many failed to conclude anything at all. Reviewers of the research failed to unravel the conflicting results. The conventional wisdom holds that research fails to demonstrate the efficacy or benefits of small classes.

Teachers have always been frustrated by this failure of research to confirm what from their personal experience and tacit knowledge seems so obvious. They feel that it is more difficult to work when confronted with greater numbers of students. It is harder to know each student--what Johnny's reading level is today or how to solve Jenny's current difficulty in arithmetic. The range of possible teaching strategies is restricted in large classes. With greater numbers it is harder to be effective and, hence, (in the teacher's view) the pupils learn less.

But anecdotal evidence is not honored by policy-makers. In the

present political climate, one must demonstrate "scientifically" that decreasing class size has social utility--produces higher achievement test scores at a reasonable cost.

Because the research evidence appeared conflicting, the debate over increasing or decreasing class size has become more political than scientific. Constituencies pull one way or the other, each marshalling that part of the evidence that supports its own case. The decisions eventually made on class size are determined less by evidence than by which side has the greater political power.

In earlier papers (Glass & Smith, 1978, 1979) we presented the results of a statistical integration of the research on the relationship between class size and achievement. Eighty studies were gathered, read, and their separate results translated into a common metric. When this metric was summarized, we demonstrated a substantial relationship between class size and achievement. Those studies which employed rigorous controls yielded results which taken together, showed that:

> As class-size increases, achievement decreases. A pupil, who would score at about the 63rd percentile on a national test when taught individually, would score at about the 37th percentile in a class of 40 pupils. The difference in being taught in a class of 20 versus a class of 40 is an advantage of ten percentile ranks . . . . Few resources at the command of educators will reliably, produce effects of that magnitude.
>
> Glass and Smith, 1978 (p. i)

Improved academic achievement is not the only justification for decreasing class size. In a climate less influenced by the systems approach to evaluation, one might argue that achievement is not even the best criterion for judging the value of decreasing class size. After all, it is

not the class size per se which directly affects achievement. Nor is class size the sole determinant of achievement. Achievement reflects the pupils' intellectual abilities and levels of effort as well as the classroom processes to which they are exposed. Furthermore, an assessment of school effectiveness based on achievement tests ties us to all the limitations inherent in such tests. Achievement is at best a distal effect, several steps removed from class size. More directly affected by varying class sizes, so the argument goes, are the opportunities the teacher has for doing different things. This is not to say that each teacher will avail himself of these opportunities or that those teaching strategies chosen will inevitably be more propitious. But on the average, the environment and teaching processes afforded by decreased class size may produce in turn higher achievement test results.

Differing class sizes may affect the workload, morale, and perceptions of teachers, thus producing differences in teaching performance, which again lead to variation in achievement. Furthermore, pupils' self-esteem, their satisfaction with school, and a favorable affective and social climate in the classroom are desirable effects in themselves. They may also produce or be produced by improved achievement. To the extent that decreased class size is related to a favorable affective climate, one may defend class size as an important condition, and one which is within the power of educators to manipulate.

Against these arguments for the benefits of small classes, the opposing positions must be weighed. First is the notion that teaching processes do not change as class size decreases--some teachers lecture even with a class size of ten. Nor is teacher knowledge of pupil characteristics

necessary for pupil learning to take place. Second is that the positive effects of small classes on teachers merely reflect laziness or worse--a political ploy to make teaching less work or to increase the numbers of teachers, hence the power of teachers' unions. The third argument is that small classes actually harm students.

> It can be argued that reductions in class size have a very serious non-academic effect. The primary rationale offered for class size reduction is to allow more individualized attention to the pupils. It seems logical to assume that such would encourage greater dependency by the pupils, "teach" them to expect the world to take care of them, and dull their abilities to develop personal initiative. If so, our reductions in class size over the years would therefore be partly to blame for the claimed decline in the motivation and discipline of our young workers.
>
> Sagness (undated)

Thus arguments pro and con were interesting enough for us to pursue the question of whether decreasing the size of classes produces improvements on non-achievement outcomes--teaching processes, and student and teacher effects in the affective domain. As in the previous study (Glass and Smith, 1978, 1979), we addressed the question with meta-analysis--the synthesis of extant studies--and also as in the previous study, we found an affirmative answer.

METHODS OF THE STUDY

The present study should be thought of as a companion piece to the earlier meta-analysis of the effect of class-size on achievement (Glass and Smith, 1979). The same literature search produced documents for both studies. The documents were described and categorized on the same set of

characteristics. The same procedures were used to quantify the outcomes generated in the documents. The statistical techniques applied to the data were modified slightly from the earlier study because of the intervening development of improved techniques. These methods are explained in this section.

LITERATURE SEARCH

Standard procedures for searching the literature were used. Secondary sources such as the Encyclopedia of Educational Research were consulted. Reviews of research such as Ryan and Greenfield (1975) yielded numerous titles. Of the documents obtained in this preliminary phase, their bibliographies led us to other titles. The ERIC system and Dissertation Abstracts were searched on the basis of keywords "size," "class size," and "tutoring." This covered the dissertation literature from 1900 to the present and the fugitive educational research literature from the mid-1960s to the present. The archival literature was searched from 1900 to the present. Abstracts and documents were scanned and those appearing to fit our requirements were bought. Many documents were sent to us by colleagues familiar with the project.*

Unlike some previous reviewers of the class size literature, we placed no restrictions on the studies selected--whether they employed rigorous empirical methods or compared classes of certain pre-determined sizes. Such restrictions often inject an unknown direction and degree of bias into the conclusions of a review. Our strategy is to categorize the features of a study, such as the sizes compared, and the degree of rigor employed in the design, and then relate these variations to differences in the size of effect produced in a study. Our requirements for selection

*The assistance of Dr. Bernard McKenna of the National Education Association is gratefully acknowledged.

of documents were liberal--the experimenter must have compared the effects of classes of two or more different sizes, the results must have been presented in some quantified or statistical form, and the study must have been conducted in some educational or quasi-educational setting. These requirements excluded articles with solely narrative presentations of experiences and opinions, theoretical pieces, and experiments in laboratory settings such as psychological studies of problem-solving in groups of various sizes. To be included, the study did not have to be focused directly on class size. Large-scale evaluation studies such as the Coleman Report were included if they had statistical relationships between class size and educational effects.

Approximately 130 documents were found to fit our selection criteria. They were subcategorized by the type of effect produced. Those dealing with achievement results were included in the first meta-analysis. Those dealing with effects other than achievement were identified for the present study. These results included affective effects on students (self-concept, interest in school, attention, attendance), effects on teachers (workload, morale, attitude toward students), and effects on the instructional processes and environment (individualization, variety of learning activities, affective climate). Some studies fell into both achievement and non-achievement categories and thus were included in both meta-analyses.

CODING CHARACTERISTICS OF THE STUDIES

Once the documents were identified and obtained, various characteristics of the research studies were coded or given quantitative descriptions. Coding the studies allowed us to address more refined research questions. For example, by coding the experimental rigor of the studies it is possible

Table 1

Class-Size (II) Coding Sheet

IDENTIFICATION:

1) Study ID#:____-____. 2) Authors:_____. 3) Year:____

4) Source of data: __Journal __Book __Thesis __Unpublished report

5) Classification of study: __Class size __Ability grouping __Tutoring
__Psycnol. experiment __Secondary analysis

6) Country of origin:_____

INSTRUCTION:

1) Subject taught: __Reading __Math __Language __Other:_____

2) Duration of instruction: ____hrs. ____weeks

3) Supplemental vs. integral: __Instruction supplemented other large group instruction.
__Instruction constituted entire teaching of the subject.

4) Adaptation of instruction to class size:
Type of instruction in smaller class:_____

_____

Type of instruction in larger class:_____

_____

	Smaller Class	Larger Class
5) No. of pupils:		
6) No. of instructional groups:		
7) No. of instructors:		
8) Pupil/instructor ratio:		
9) Accuracy of estimate of ratio:	Lo Av Hi	Lo Av Hi

10) Instructor type: __Teachers __Adult aides of tutors __Both

11) Sex of teacher: __M __F

12) Years of teaching experience: ____years

CLASSROOM DEMOGRAPHICS:

1) Pupil ability: __IQ < 90 __90 ≤ IQ ≤ 110 __IQ > 110

2) Percent pupils female: ____%

3) Ages: 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 18+

4) Average age: ____years

STUDY CONDITIONS:

1) Study setting: __Regular classroom __Experimental setting

2) Assignment of Ss to groups: __Random __Matched __"Repeated measures"
__Uncontrolled

3) Assignment of instructors to groups: __Random __Matched __"Repeated measures"
__Uncontrolled

4) Percent attrition: Small class: ____% Large class: ____%

OUTCOME VARIABLES:

Number 1/___. Domain___. Metric___. Follow-up_____(weeks).
Standardized mean difference (Small-Large)_____Δ
Description_____

_____

_____

Number 2/___. Domain___. Metric___. Follow-up_____(weeks).
Standardized mean difference (Small-Large)_____Δ
Description_____

_____

_____

Number 3/___. Domain___. Metric___. Follow-up_____(weeks).
Standardized mean difference (Small-Large)_____Δ
Description_____

_____

_____

Number 4/___. Domain___. Metric___. Follow-up_____(weeks).
Standardized mean difference (Small-Large)_____Δ
Description_____

_____

_____

Number 5/___. Domain___. Metric___. Follow-up_____(weeks).
Standardized mean difference (Small-Large)_____Δ
Description_____

_____

_____

Number 6/___. Domain___. Metric___. Follow-up_____(weeks).
Standardized mean difference (Small-Large)_____Δ
Description_____

_____

_____

Domain:
A=Student Attitude
B=Individualization
C=Participation
D=Enrichment
E=Inappropriate Behavior
F=Interpersonal Regard
G=Open Education
H=Other
I
J

Metric:
M=Simple gain scores
N=Residualized gains
O=Uncorrected
P=Categorical Percentages

to say whether larger class-size effects are produced by well-designed versus poorly-designed studies. By coding the studies for the age of the pupils used as subjects it is possible to say whether larger class-size effects are associated with younger versus older pupils. An initial review of part of the documents and discussion with experts in the field about which characteristics might interact with class-size effects resulted in a selection of characteristics of the studies to be coded. These characteristics were included in a coding sheet (see Table 1) major items of which are reported below. One coding sheet was filled out for each pair of class-sizes compared within a study. If a researcher compared classes of size 5, 10, and 15, for example, 3 coding sheets (representing 3 paired comparisons) would be filled out. The first would represent the comparison of class size 5 (small class) versus class size 10 (large class). The second would represent class size 5 (small) versus class size 15 (large). The third would represent class size 10 (small) versus class size 15 (large). Each outcome measure used by the researcher as a criterion was recorded separately as a unit of analysis of class-size effect. Suppose that in the above example two outcomes were used: pupil self-concept and classroom climate. Thus this one study would contribute 3 (paired comparisons of class sizes) X 2 (outcomes) = 6 (class-size effects). In all, the 59 studies produced 371 class-size effects, which comprised the body of data for meta-analysis.

Year of the Study. The year of publication of the study was included to check whether the class-size effect is different in different eras of research. Table 2 contains frequencies and percentages of the data base produced in different years. The earliest study was published in 1925. Half of the data base was produced by about 1969. The final year covered by this project is 1978.

Table 2

Frequencies and Cumulative Percentages

of the Data Base Produced in Years 1925-1978

Year of Study	Frequency	Percentages	Cumulative Percentages
1925-1939	26	7.3%	7.3%
1940-1944	15	4.2%	11.5%
1945-1949	1	.3%	11.8%
1950-1954	4	1.1%	12.9%
1955-1959	40	11.2%	24.1%
1960-1964	24	6.7%	30.8%
1965-1969	104	29.1%	59.9%
1970-1974	53	14.9%	74.8%
1975-1979	104	25.2%	100.0%
	371		

Source of Study. This characteristic was included to show whether unpublished materials were associated with class-size effects smaller than those produced by journal articles, books, or dissertations. As Table 3 shows, 21 percent of the comparisons of larger and smaller classes came from journals, 15 percent from books, 38 percent from dissertations and 24 percent from unpublished sources.

Type of Study. We recorded whether the focus of the study was class size per se rather than tutoring or a large-scale evaluation. Almost all of the studies, over 90 percent, were directly aimed at testing the effects of different class-sizes. Secondary analyses, psychological experiments on group size, and ability grouping were not included in the data base.

Country of Origin. One Australian study was included. Fifteen percent of the data base came from Canadian studies. The rest were American. The lack of variation on this characteristic prevented us from classifying the class-size effect by country of origin.

Subject Taught. We recorded the subject matter taught as the basis for the class-size experiment. The predominant category was "all subjects," representing 57 percent of the data base. These comparisons arose from experiments with all-day self-contained classrooms. Other categories contained data too sparse to answer the question of whether there is a different class size effect in teaching different subject matter. Table 4 contains the breakdown of the data base by subject taught.

Duration of Instruction. The amount of teaching was recorded in hours and weeks. The number of hours of instruction varied from a single hour to 6,000 hours with a mean of over 450 hours and a similar standard

Table 3

Frequencies and Percentages

of Data Base Produced by Four Sources of Study

Source of Study	Frequencies	Percentage
Journal	75	20.2
Book	52	14.0
Thesis	139	37.5
Unpublished Report	89	24.0
Other	16	4.3
	371	

Table 4

Frequencies and Percentages of the

Data Base (Deltas) Associated with Different Subjects Taught

Subject Taught	Frequencies	Percentage
Reading	2	.5
Math	1	.3
Language	3	.8
All Subjects	213	57.4
English or Writing	10	2.7
Social Studies	42	11.3
Education	22	5.9
Science	18	4.9
Other	60	16.2
	371	

deviation. Weeks of instruction varied from one to 36 with a mean of 25 and a standard deviation of 12.

Supplemental or Integral Instruction. Instruction was described as to whether it constituted all of the instruction on the subject that the pupil received ("integral") or whether it supplemented other instruction on the subject ("supplemental"). For 73 percent of the data base the instruction was integral, and for 19 percent, the categorization could not be determined.

Number of pupils, groups, and instructors. The number of pupils, instructors, and instructional groups was each recorded for the large and small class. The number of pupils was not the same as the class size since there might have been several small or large classes used in the study. The pupil/instructor ratio is the measure of class-size. The meaning of class-size in this investigation is the number of pupils under the guidance of a teaching adult for the period of time studied. One teacher with a group of 30 pupils counts as P/I = 30; two teachers in a class of 30 gives P/I = 15. One teacher and an instructional aide (not a clerical aide) in a class of 30 gives P/I = 15.

Accuracy of Estimate of Ratio. The accuracy of the determination of the P/I ratio was rated as either low, average, or high. A "high" rating meant that the exact number of pupils per teacher was known. An "average" rating meant that class-size was given as a narrow range of pupils, e.g., "25-30" or "18-21." "Low accuracy meant that class-size was reported only as a broad range, e.g., "20-30" or "less than 15." Most estimates were given an average rating.

Instructor Type. It was noted whether the instruction was given by teachers or adult aides and tutors.

Sex and Experience of Teachers. Although we intended to record these characteristics of teachers, virtually no information was available on them.

Table 5

Numbers of Pupils, Instructors, and Pupil/Instructor Ratio for Small Class/Large Class Paired Comparisons

	Small Class	Large Class
Number of Pupils in the Study		
Range	20 - ∿ 100,000	22 - ∿ 100,000
Mean	3,582	3,895
Standard Deviation	10,740	11,244
Number of Instructors in the Study		
Range	1 - ∿ 1,000	1 - ∿ 1,000
Mean	59	45
Standard Deviation	158	148
Pupil/Instructor Ratio		
Range	1 - 78	4 - 189
Mean	20	45
Standard Deviation	10	30

Pupil Ability. Average IQ of pupils was noted as either 1) below 90; 2) 90 to 110; or 3) above 110. If no information was provided by the researcher pupil ability was estimated as average. This was the usual situation, so that there was not sufficient variation to detect different class-size effects for different levels of pupil ability.

Percent Pupils Female. Although it might have been assumed that this figure would be near 50% in elementary classes, it was virtually never reported and we seldom used this variable.

Average Pupil Age. The typical age of the pupils involved in the study was noted, so that interactions between age and class-size effects could be detected. Ages ranged from 5 to 22 with a mean of 13 and standard deviation of 2.

Study Setting. The setting in which the study took place was noted. Since the studies took place almost exclusively in regular classroom settings, this variable proved irrelevant to subsequent analyses.

Assignment of Pupils and Teachers to Groups. These variables were important in describing the degrees of experimental control exercised in the study. "Random" is obvious; "matched" refers to attempts to equate small and large classes by other than random means on pretests of achievement or ability; "repeated measures" refers to using either the same pupils or teacher in both small and large classes, e.g., 10 pupils might be taught alone and then in a group of 40 and their achievement compared; "uncontrolled" should be obvious. Of the entire data-base, 16 percent came from studies which used randomization, 6 percent came from matched group studies, 17 percent came from "repeated measures" studies, and 61 percent came from uncontrolled studies.

Percent Attrition. This is also a concern for experimental validity, but it was reported too infrequently to be useful.

Metric of Measure. The metric used in the measurement of outcomes was recorded. In some instances, a degree of experimental control could be attained by expressing achievement as gains from pretest to posttest or covariance adjusting posttest means for pretest differences. However, 53 percent of the outcome measures were uncorrected for pre-existing differences. Another 40 percent used data in the form of percentages (also uncorrected). Six percent of the data were in the forms of correlations. Only three percent used corrected data.

Domain of Effect. Measures of class-size effects were coded so that any interactions between the magnitude of effect and the type of variable could be detected. The classification system was suggested by Dr. Nikola N. Filby of the Far West Lab and was modified slightly by the authors. It is presented in Table 6. Effects were grouped in various ways, and the issues involved in such groupings are discussed in the next section.

QUANTIFICATION OF EFFECTS

A simple statistic was desired that would describe the relationship between the class-size and its effects as determined by a study. No matter how many class-sizes are compared in a study, the data can be reduced to some number of paired comparisons, a smaller class against a larger class. Certain differences in the findings must be attended to if the findings are later to be integrated. The most obvious differences involve the actual numbers of pupils in what are designated "smaller" and "larger" classes and the scale properties of the measure of effect. The actual class-sizes compared must be preserved and become an essential part of our

Table 6

Primary Classification of Effects (Filby Categories)

Student Attitudes
- Attitudes toward teachers
- Attitudes toward school or class
- Self-concept
- Mental health
- Attitude toward educational program
- Motivation
- Preference for class size
- Attitude toward life

Individualization
- Teacher knowledge of pupils
- Amount of individual student-teacher interaction
- Number of variety of activities
- Amount of seatwork or students working on individual tasks
- Amount of work in small groups
- Teacher attention to individual students
- Adaptation of teaching to individuals
- Building foundation for independent work
- Conferences with parents

Student Participation in Learning
- Participation in discussions or lesson
- Generation of and reponse to questions
- Interest and enthusiasm for classwork
- Attendance
- Study habits
- Student directedness
- Student engagement
- Difficulty in learning
- Attention
- On-task behavior

Enrichment
- Creative activities
- Dramatics
- Divergent thinking
- Use of manipulative materials

Classroom Behavior
- Aggression
- Off-task behavior
- Apathy
- Friction
- Difficulty
- Discipline
- Dependence

Table 6 continued

Anxiety
Teacher control
Good behavior
Frustration
Character development

Interpersonal Regard
Peer group links
Student social interaction
Cohesiveness
Friendly teacher-student relationship
Sociometric choice

Open Education
Freedom of movement in the classroom
Student choice of activities
Informality
Social interaction

Quality of Instruction
Creative instruction
Use of teaching aids
Teacher organization and planning
General quality
Amount of material covered
Task structuring
Positive evaluation
Varied learning activities
Innovation

Teacher Attitude
Morale
Attitude toward students
Perceptions and satisfaction
Expectations for performance
Workload
Absences
Professional growth

School Climate
General climate
Innovations and adaptations in the school
Use of school space

descriptive measure. The measurement scale properties can be handled by standardizing all mean differences in the effect (teaching process, affective outcomes) by dividing by the within group standard deviation. The eventual measure of relationship is straightforward and unobjectionable:

$$\Delta_{S-L} = \frac{\bar{X}_S - \bar{X}_L}{\hat{\sigma}}$$

where:

$\bar{X}_S$ is the estimated mean effect of the smaller class which contains S pupils;

$\bar{X}_L$ is the estimated mean effect of the larger class which contains L pupils; and

$\hat{\sigma}$ is the estimated within-class standard deviation assumed to be homogeneous across the two classes.

The resulting effect measures or Δ's (deltas) are in a common metric which may then be summarized across studies. The Δ's are standardized mean differences for a given pair of class sizes and as such are similar to z-scores. If one assumes normality of the distribution it is possible to interpret a Δ_{S-L} of +1 to mean that the average pupil in the smaller class would score at the 84th percentile of the larger class.

When a researcher failed to report means and standard deviations for class-size effects it was necessary to solve for Δ's by using the F, t, X^2, or correlational statistics and formulas documented elsewhere (Glass, 1978; Glass and Smith, 1979). Probit transformations were used on categorical data and data reported in percentages.

INTEGRATING RESULTS OF "DIFFERENT EFFECTS"

Those who flinch at the integration of results from reading tests and math tests will find the integration of all non-achievement effects even more disturbing. These effects range from the extent of individualized instruction in the classroom to student's attitude toward life. But what these variables have in common is that each has been chosen by a class-size researcher as a hypothesized effect of varying class-size. These researchers had in mind that each of these variables related in some way to the quality of education. Despite their uniqueness, each variable can be scaled so that one end represents educational improvement or the desired state of education. At the coarsest level of aggregation, these effects answer the question, "Are small classes better learning environments than large classes?"

We moved away from this coarse level of aggregation to a more specific one, in which effects were separated into 1) affective effects on pupils, 2) effects on teachers, and 3) effects on instructional environments and processes (see Table 7). This system for scaling and categorizing effects was one of several we tried out in an attempt to find contingent (interactive) class-size effects. None of the other methods revealed such interactions, and they will not be reported here. At the most specific level were ten categories of outcome, already presented in Table 6, representing student attitudes, individualization of instruction, student participation in learning, enrichment activities, classroom behavior, interpersonal regard, "open education," general quality of instruction, teacher attitude, and school climate. Unfortunately, several of these more specific categories had insufficient data to detect interactions with the class-size effects. Those which had sufficient data produced results consistent with those of the more general grouping described above and thus are not reported here.

Table 7

Secondary Classification of Effects into Affective Effects on Pupils, Effects on Teachers and Effects on the Instructional Environments and Processes.

Student Effects

- Attitude toward teachers
- Attitudes toward school or the class
- Self-concept
- Mental health
- Attitude toward educational program
- Motivation
- Preferences for class size
- Attitude toward life
- Participation in discussions and lesson
- Generation of and response to questions
- Interest and enthusiasm for classwork
- Attendance
- Study habits
- Student engagement
- Difficulty in learning
- Attention
- On-Task behavior
- Divergent thinking
- Off-task behavior
- Apathy
- Friction
- Difficulty
- Dependence
- Discipline
- Anxiety
- Good student behavior
- Frustration
- Character development
- Peer group links
- Student social interaction
- Sociometric choice

Teacher Effects

- Teacher organization and planning
- Morale
- Attitude toward students
- Perceptions and satisfactions
- Workload
- Absences
- Professional growth

Table 7 continued

Instructional Effects

- Teacher knowledge of students
- Amount of individual teacher student interaction
- Number and variety of learning activities
- Amount of seatwork or student working on individual tasks
- Amount of work in small groups
- Teacher attention to individual students
- Adaptation of teaching to individuals
- Building foundation for independent work
- Conferences with parent
- Creative activities
- Dramatics
- Teacher directiveness
- Use of manipulative materials
- Amount of teacher control
- Positive teacher control
- Cohesiveness
- Friendly student teacher relationships
- Freedom of movement in classroom
- Student choice of activities
- Informality
- Social interaction
- Goal direction
- Creative instruction
- Use of teaching aids
- General quality of instruction
- Amount of material covered
- Task structuring
- Positive evaluation
- Varied learning activities
- Innovation
- General school climate
- Use of space
- Expectations for performance

STATISTICAL ANALYSIS

The over-all advantage of small classes over large classes cannot be represented simply by an average of Δ_{S-L}. Both the small class-size and the large class-size represent a wide range of values. Many techniques have been employed to state the over-all magnitude of Δ_{S-L} as a function of the size of the respective classes and the differences in the two class-sizes which were compared. After developing and evaluating these techniques, the one selected was the logarithmic model, which best represented the relationship of class-sizes and achievement effects (Barton and Glass, 1979).

The use of the logarithmic model arose from the expectation that class-size and non-achievement effects might be related in something of a non-linear fashion--reasoning that one pupil with one teacher acquires an interest in the subject of intensity A, two pupils develop somewhat less intense interest, three even less, and so on. Furthermore the drop in interest from one to two pupils could be expected to be larger than the drop from two to three, which in turn is probably larger than the drop from three to four, and so on. A logarithmic curve represents one such relationship:

$$z = \alpha - \beta \log_e C + \varepsilon, \text{ where} \qquad (1)$$

C denotes class-size.

In formula (1), α represents the effect for a "class" of one person, since $\log_e 1 = 0$, and β represents the speed of decrease in effect as a class-size increases. The general curve is graphed in Figure 1.

Formula (1) cannot be fitted to data directly because z is not measured on a common scale across studies. This problem can be circumvented by calculating Δ_{S-L} for each comparison of a smaller and a larger class

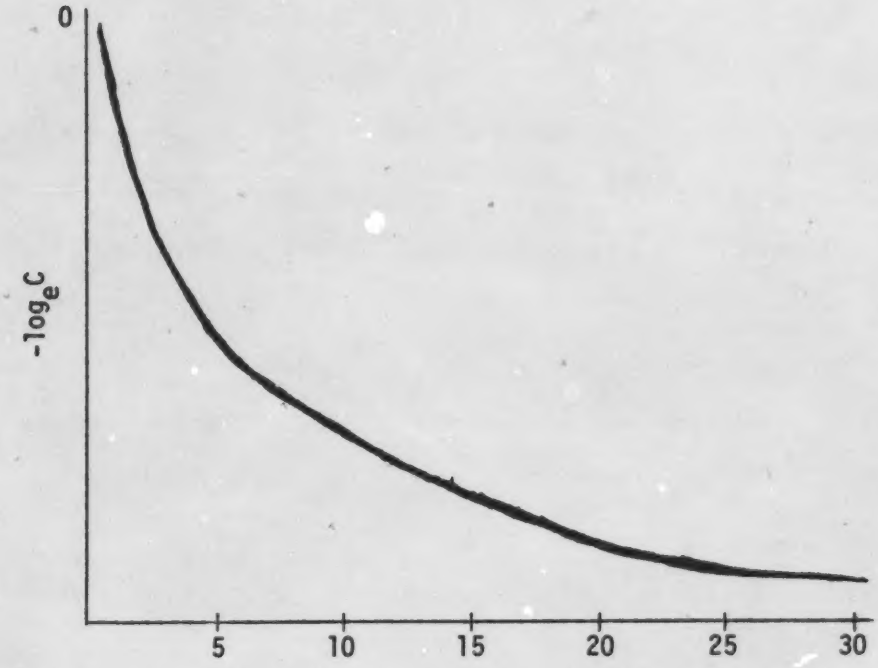


Figure 1. Graph of the log curve for the model in formula (1)

within a study. Then, from formula (1), one has

$$z_S - z_L = \Delta_{S-L} = (\alpha - \beta \log_e S + \varepsilon_1) - (\alpha - \beta \log_e L + \varepsilon_2)$$
$$= \beta(\log_e L - \log_e S) + \varepsilon_1 - \varepsilon_2$$
$$= \beta \log_e (L/S) + \varepsilon. \qquad (2)$$

The model in formula (2) is particularly simple and straightforward. The values of Δ_{S-L} are merely regressed onto the logarithm of the ratio of the larger to the smaller class-size, forcing the least-squares regression line through the origin.

The solution for the least-squares estimate of β turns out to be particularly simple and straightforward.

$$\hat{\beta} = \frac{\Sigma(\Delta_{S-L})(\log_e L/S)}{\Sigma(\log_e L/S)^2} \qquad (3)$$

Once β is estimated from the data Δ_{S-L} and $\log_e(L/S)$, estimates of the outcomes variable $\underline{z}$ can be obtained for the full spectrum of the class-size continuum by plotting the curve

$$\hat{z} = \hat{\beta}\log_e C \ . \qquad (4)$$

The fit of the log model to the data can be examined by inspecting the scatterdiagram of Δ_{S-L} and $\log_e(L/S)$ for departures from linearity. Furthermore, if $\underline{z}$ is assumed to be normally distributed, then $\hat{\underline{z}}$ can be transformed into percentile units that can be more readily understood by many readers.

The statistical model adopted for analysis of the data in this report is believed to be an improvement over the methods used to analyze the data in our earlier work on class-size and achievement (Glass & Smith, 1978). In the former analysis, achievement was regressed onto a tri-variate linear combination of $\underline{L}$, $\underline{S}$, and $\underline{S}^2$. The equation was fit by the method of least squares estimation. This method seemed reasonable, and it was suited to the anticipated curvilinear relationship between class-size and achievement. However, it permitted no simple representation of the relationship in two dimensions where it might be easily seen and understood. Our attempt to reduce the four dimensional regression space to a plane was accomplished non-arbitrarily, but the solution by means of one or more "pivot points" seemed problematic; 1) there was more than one point that satisfied the

conditions of "pivot point" and the reasons for choosing one over the others were unclear, 2) it was difficult to estimate how well determined by data the line was that resulted from constraining the four dimensional regression surface into two dimensions; and 3) the entire business was clumsy and inelegant. The logarithmic model described above had none of these shortcomings, and in addition it fit the data with a slightly smaller residual error mean square than the three parameter regression model.

FINDINGS

Despite the large range in class-sizes, there was a substantial average value for Δ_{S-L}, amounting to almost one-half standard deviation across all types of non-achievement effect. This finding indicates that "smaller is better" even before we use the loagrithmic model to define precisely what "smaller" is. The comparable finding for the achievement data--the uncorrected average Δ_{S-L}--was .011, a remarkable difference.

The subsequent findings are presented in a series of figures which depict the curves of the magnitude of effect related to class-size, first for the data as a whole and then for different parts of the data set. The metric used to display the effects consists of percentile ranks derived from

standard-score equivalents. For convenience of interpretation the curves have been standardized so that a class size of 30 represents the 50th percentile of effects.

THE DATA AS A WHOLE

In Figure 2 is plotted the curve of effects calculated for class sizes 5 through 70 for the data as a whole. Table 8 contains the equivalent calculations. In column one appear the class-sizes against which the effects are calculated. Column two contains the values of $\hat{z}$, the class-size effects, calculated as follows: $\hat{z} = \hat{\beta}(\log_e C)$ where $\hat{\beta}$ is the estimated regression slope of Δ onto $\log_e(L/S)$, and C is class-size. The third column is for z' and is the adjustment of the class-size effect so that a class-size of 30 is the anchor point, at the 50th percentile of effects. The fourth column is the series of percentile equivalents for z'. Across the 371 Δ_{S-L}, the average is .49 and the standard deviation is .70. The value of $\hat{\beta}$ is .47.

These findings indicate that there is a beneficial effect on the general quality of the educational environment resulting from decreasing class size.

Suppose that the typical level of non-achievement benefits experienced by the average pupil in a class of 30 pupils is set equal to the 50th percentile. The results in Table 8 indicate that if this pupil were placed in a class of size 20, he would experience non-achievement benefits superior to 58 percent of the pupils who are taught in classes of size 30. In a class of 10 pupils, he will benefit more than 70 percent of the pupils in classes of 30, though he started out at the median (50th percentile) of such classes. On the other hand, increasing his class from 30 to 40

Table 8

The Calculation of Class-Size Effects for the Data as a Whole

Class Size	$\hat{z}$	z'	Percentile Rank
5	.76	.84	80th
10	1.08	.52	70th
15	1.27	.33	63rd
20	1.41	.19	58th
25	1.51	.09	54th
30	1.60	0	50th
35	1.67	-.07	47th
40	1.73	-.13	45th
50	1.83	-.23	41st
60	1.92	-.32	38th
70	2.00	-.40	37th

$\hat{\beta} = .47$

$\overline{\Delta}_{S-L} = .49$

$\hat{\sigma}_{\Delta_{S-L}} = .70$

$n_{\Delta_{S-L}} = 371$

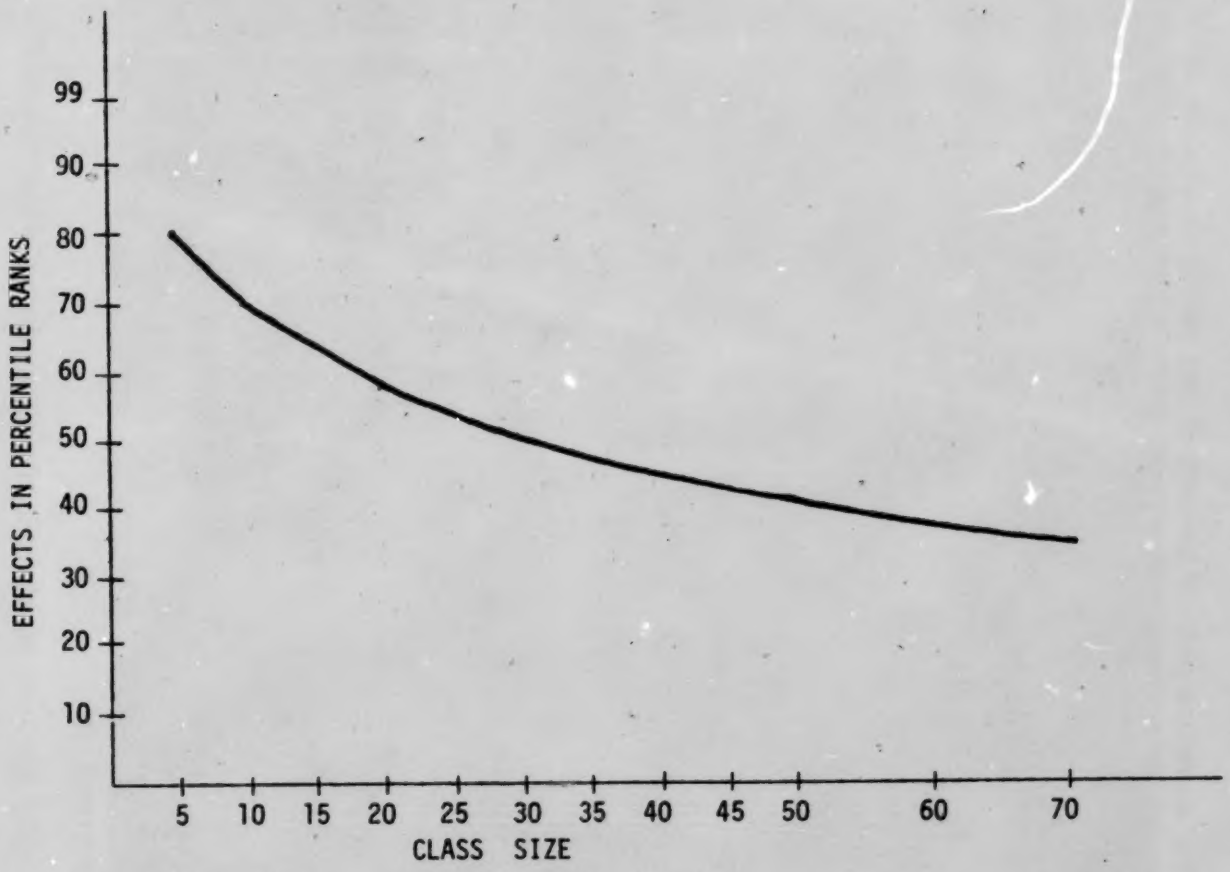


Figure 2. Graph of the relationship of class-size and effects on attitudes and instruction (the data as a whole). $n_{\Delta_{S-L}} = 371$. $\hat{\beta} = .47$.

pupils would result in a decline in non-achievement benefits; 55 percent of the pupils in classes of 30 pupils would now experience greater benefits than he. In a class of 60 pupils, this hypothetical average student would gain benefits exceeding only 38 percent of the pupils in classes of 30 pupils. Even at this coarsest level of aggregation, class-size does make a difference. Figure 3 shows the effects of class-size on achievement compared to its effects on attitudes and instruction.

The next task is to subdivide the data into more meaningful portions and to plot the class-size curve for each subset. This task answers questions about the interaction of class-size effects with different features of the studies. For example, is the class-size effect different for pupils of different ages? Is the class-size effect different for effects on teachers as opposed to effects on pupils? Unfortunately, we have many more such questions than the data can answer. We cannot say, for instance, whether the class-size effect is different for boys and girls because the distribution of gender was constant across the studies and seldom were results reported separately for boys and girls. We cannot determine whether the class-size effect is different for teachers with different levels of experience because the researchers usually failed to record teacher experience. What we do have are answers to the following interactions: the class-size effect for various outcome classifications, pupil ages, and the sources, dates, and the internal validity of the studies.

OUTCOME CLASSIFICATIONS

Probably the most meaningful classification of effects consisted of breaking them down into 1) affective effects on pupils, 2) effects on teachers, and 3) effects on the instructional environments and processes.

Figure 4, contains the curves for effects related to class-size for pupil affective effects, teacher effects, and instructional effects

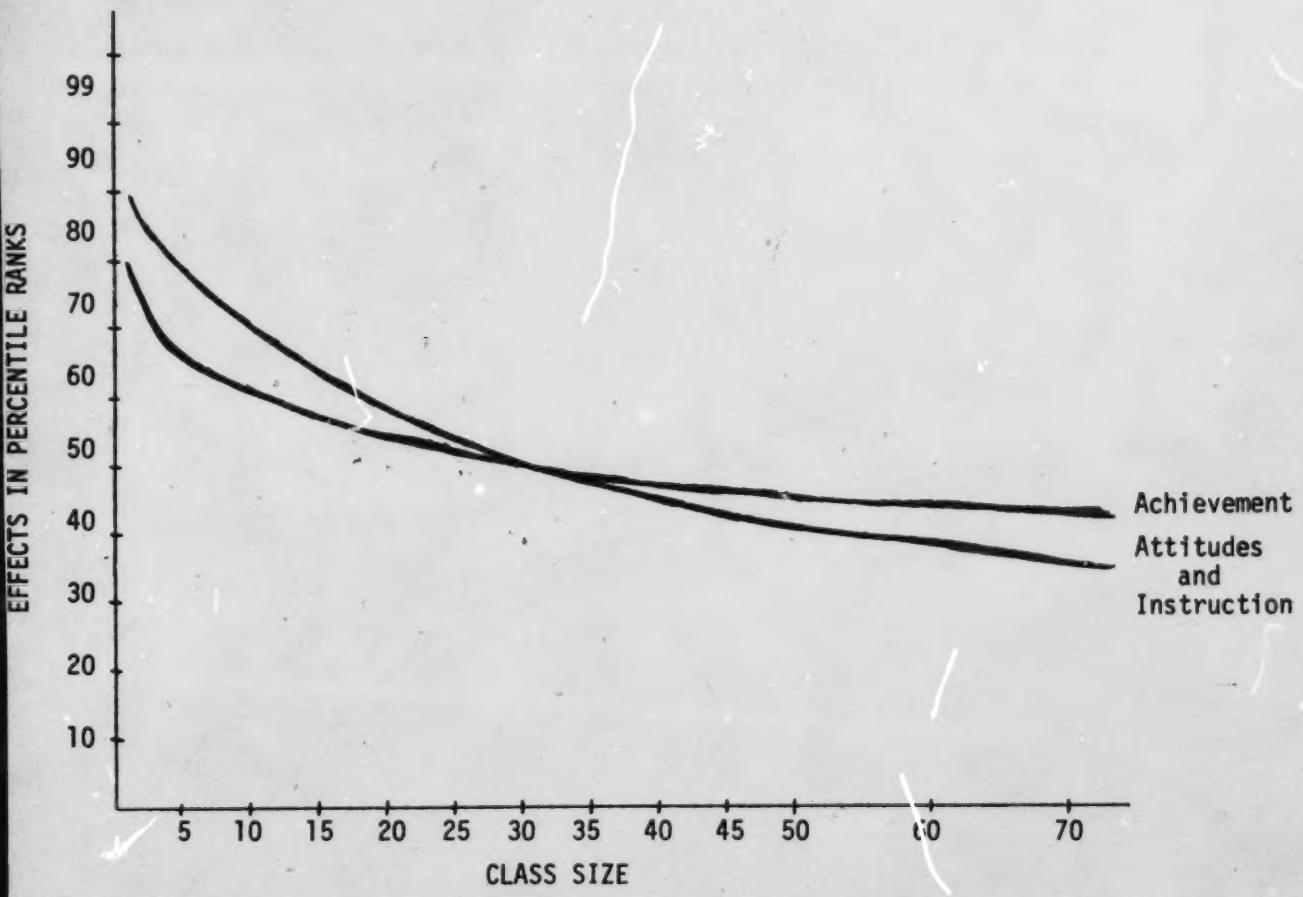


Figure 3. Graph of the relationship between class-size and achievement (after Glass & Smith, 1979 and Barton & Glass, 1979) and the relationship between class-size and attitudes and instruction (after Figure 2).

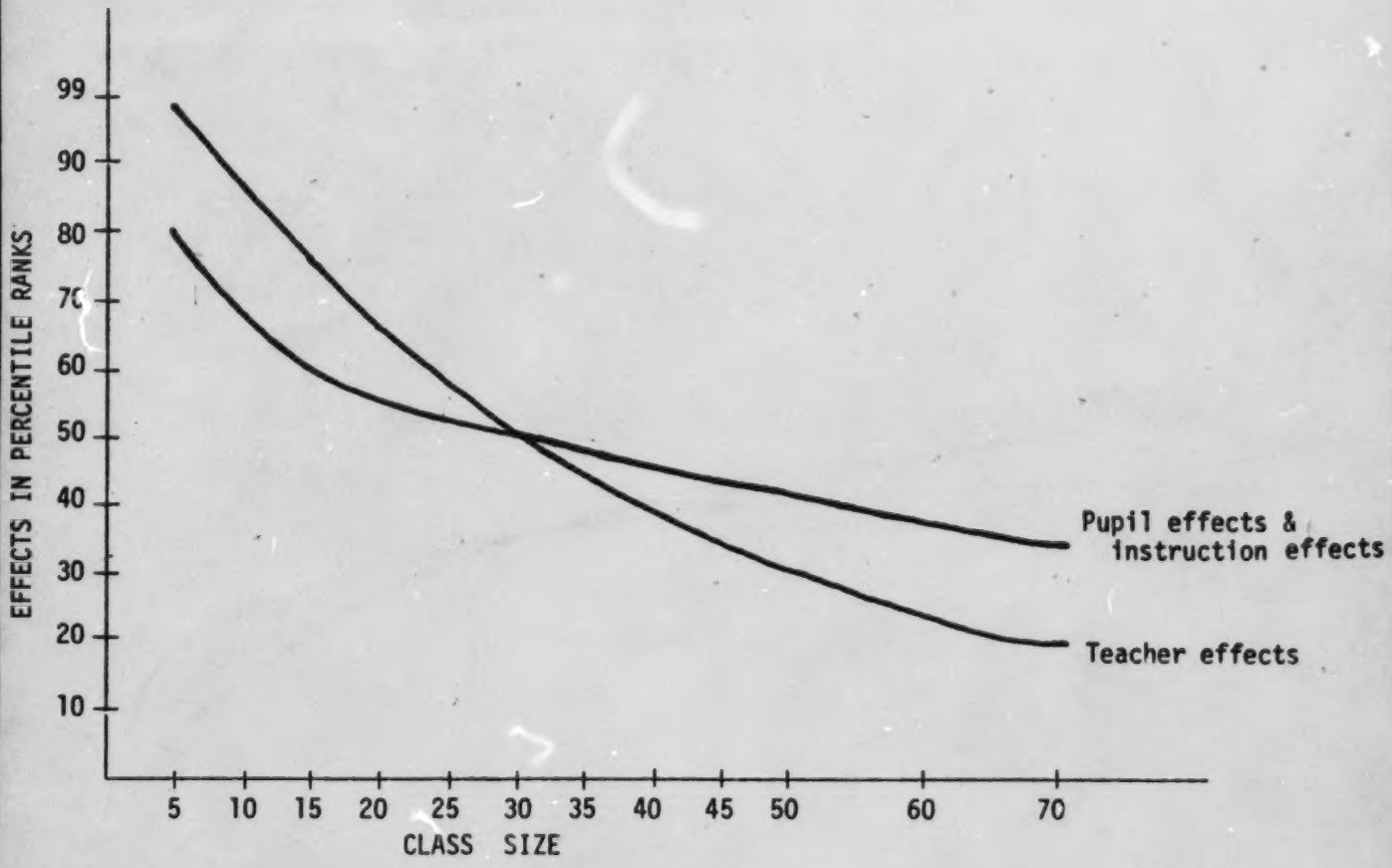


Figure 4. Graph of the relationship of class-size and affective effects on pupils ($n_{\Delta_{S-L}} = 172$, $\beta = .47$); effects on teachers ($n_{\Delta_{S-L}} = 30$, $\beta = 1.03$), and effects on instructional process ($n_{\Delta_{S-L}} = 155$, $\beta = .47$).

respectively. As can be seen from these plots, there is a difference among the three categories of effect. All three curves showed positive effects but the effects on teachers were the largest of the three.

There was a substantial effect of varying class size on teachers. The difference in a teacher's workload, attitudes about students, morale, and general satisfaction varies from the 50th percentile in a class of 30 pupils to the 76th percentile in a class of 15. The difference in teacher effects in a class of 10 versus a class of 40 is 49 percentile ranks. Thus the truism is given empirical support: teachers feel better and feel they perform better in smaller classes.

The affective effects of class-size on pupils are positive but not as dramatic as the effects on teachers. The $\hat{\beta}$ for 172 values of Δ_{S-L} is .47. Thus the difference in pupils' attitudes toward school, interest in the subject matter, classroom behavior, etc. is 14 percentile ranks between classes of size 15 and 40. A student at the 50th percentile in affective attainment in a class of 30 would be expected to rise to the 70th percentile if put into a class of 10. The size of a class does have an impact on pupils' attitudes, interests and opinions.

The effect of varying class size on instructional processes and environments is the same as the effect on pupil affect ($\hat{\beta}$ = .47 for 155 Δ_{S-L}). The opportunities for individualization, varied and adaptive learning activities, social interaction, and friendly relationships are greater in the smaller classes. Classes vary on this effect between the 70th percentile in a class of 10 pupils to the 45th percentile in a class of 40 pupils.

The effects were also categorized according to a system devised by Dr. Filby (Table 6). But five of these categories had insufficient data to

estimate the logarithmic model. The results are presented in Table 9 and support the conclusions reached above, that effects on teachers are very great and effects on student attitudes, individualization, student participation in learning, and quality of instruction are positive.

PUPIL AGE

The data were categorized by age of pupils and arranged in three groups: 1) 12 years and under; 2) 13 to 17; and 3) 18 and over. The class-size effect curve was plotted for each age group, in Figure 5.

These curves show definite differences in the class-size effect for the three age groups. The effect was greatest for pupils 12 years and under ($\hat{\beta}$ = .52), somewhat less for pupils 13 to 17 ($\hat{\beta}$ = .47) and least for pupils 18 and over ($\hat{\beta}$ = .38). Thus the class-size effect does interact with pupil age.

FEATURES OF THE STUDIES

An important finding of the meta-analysis of class size and achievement was that well-designed studies produced quite different results from studies with minimal controls. The studies dealing with non-achievement effects were subdivided according to the method used by the researcher to assign subjects to experimental conditions (i.e., randomized, matched, "repeated measures" and uncontrolled).

Although all experimental methods produced positive class-size effects, there were insufficient data to estimate separately the logarithmic model for studies with "repeated measures" (n = 18). Otherwise, more pronounced results emanated from uncontrolled studies ($\hat{\beta}$ = .57) than from studies using randomization ($\hat{\beta}$ = .44) or matching ($\hat{\beta}$ = .49) as the method of assigning subjects to treatments. Figure 6 contains the curve for two contrasting experimental methods: effects of studies using randomization and effects of uncontrolled studies.

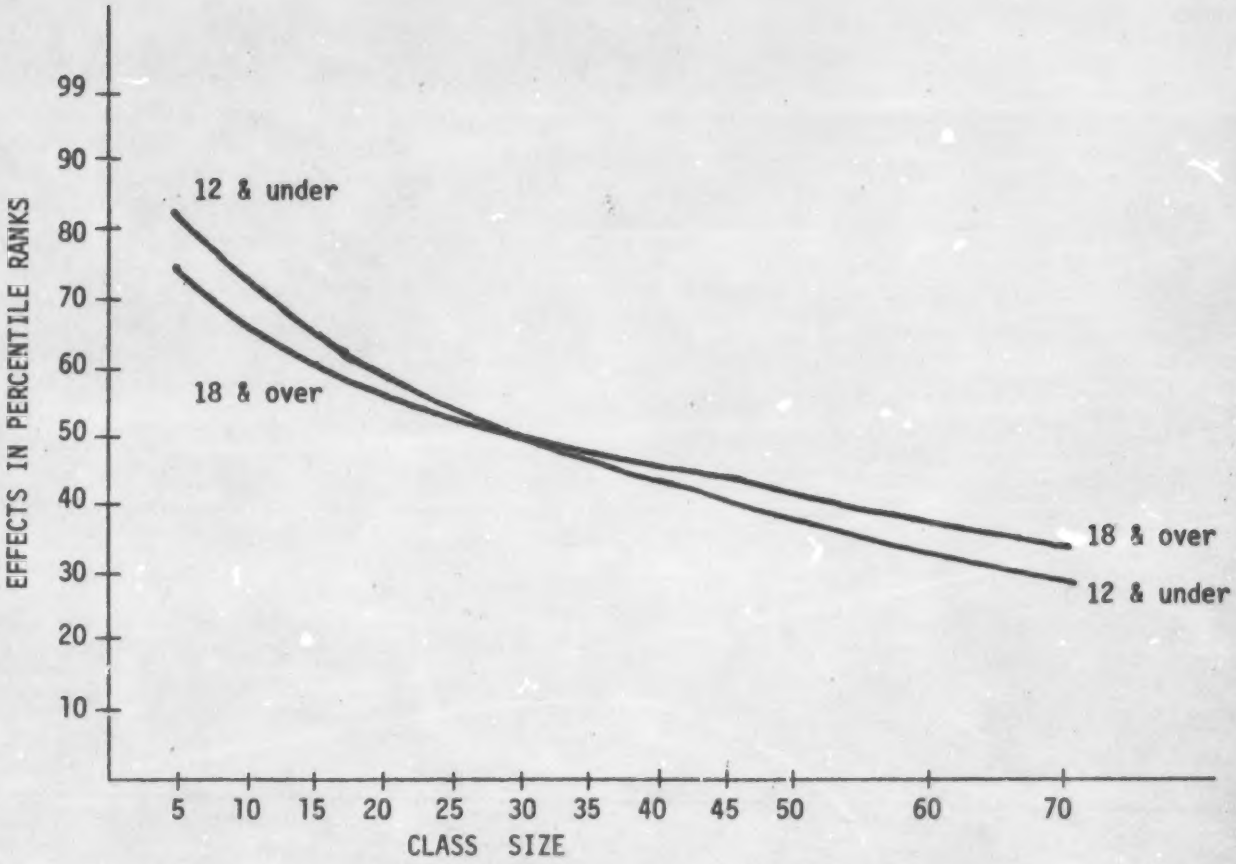


Figure 5. Graph of the relationship of class-size and effects on attitudes and instruction for pupils of different age-groups.

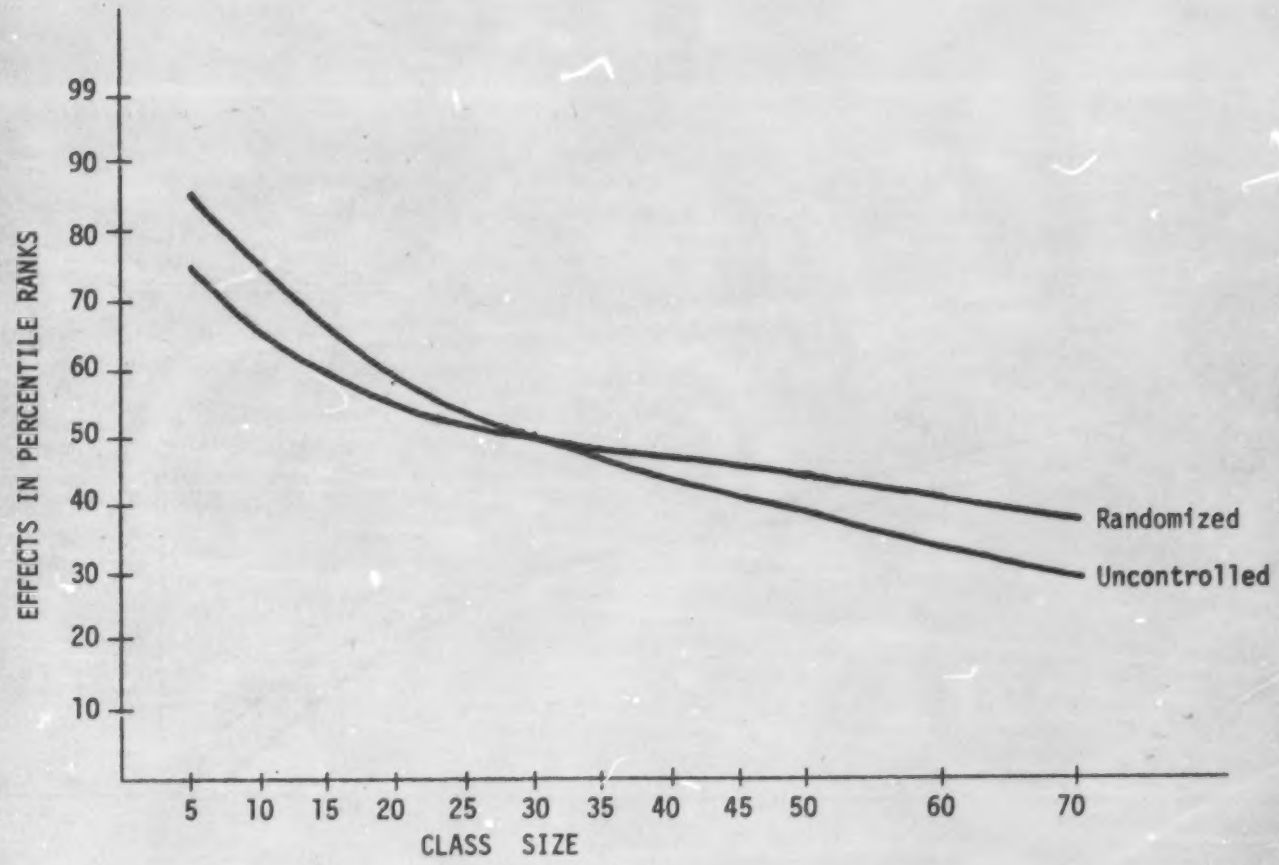


Figure 6. Graph of the relationship of class-size and effects on attitudes and instruction for studies using randomization versus uncontrolled studies (studies using matching or repeated measures produced intermediate effects and are not plotted).

Table 9

The Values of $\hat{\beta}$, Numbers of Δ_{S-L} for Effects as Categorized by Filby, with Differences in Effect Between Class-Size of 10 and 40

Category of Effect	$n_{\Delta_{S-L}}$	$\hat{\beta}$	Differences in Effects Between Class-Size 10 and 40 (Percentile Ranks)
Student Attitude	58	.43	29
Individualization	59	.36	19
Student Participation	109	.42	23
Enrichment	3	.70	*
Pupil Behavior	17	.79	*
Interpersonal Regard	19	.59	*
Open Education	4	2.28	*
Quality of Instruction	45	.31	17
Teacher Attitude	40	2.29	74
School Climate	7	2.11	*

*Insufficient data to estimate effects.

One explanation is that the poorly-designed studies are not credible and that the over-all class-size effect is inflated because 60 percent of the effects come from uncontrolled studies. The more optimistic view is that the effect of class size on the quality of education is a robust effect, detectable even with less sophisticated and powerful research methods.

To find out whether the class-size effect was conditional on the source of the study, the model was determined separately for journal articles, books, theses, and unpublished papers and plotted in Figure 7. A difference in the class-size effect was found in decreasing order from unpublished papers ($\hat{\beta}$ = 1.13) to books ($\hat{\beta}$ = .82) to journal articles ($\hat{\beta}$ = .54) to theses ($\hat{\beta}$ = .35). We made no attempt to explain this ranking except to highlight the need for reviewers to look at all sources of study lest a biased estimate of effects be made.

The median year of publication was 1969 and the studies were so divided to see if the class-size effect was greater in the more recent research (see Figure 8). This was not the case. The class-size effect was greater in studies published before 1969 ($\hat{\beta}$ = .59) than later ($\hat{\beta}$ = .42). The direction of results was the same, the magnitude of relationship differed. This is a less suspicious finding than if the direction differed.

The scatter-diagrams of the relationship between $\text{Log}_e(L/S)$ and Δ_{S-L} are presented in Figures 9, 10, and 11 for Student, Teacher, and Instructional Effects, respectively. The data revealed basically linear relationships for Student and Teacher Effects. An initial scatter-plot of the 155 Instructional Effects revealed a confusing shape with possible curvilinearity. To obtain a better picture of the shape of the relationship, multiple measures for a particular comparison of S and L within a study were averaged; 73 data points

resulted. It then became apparant that seven outlying points were distorting the basic shape revealed by the scatter-plot; five of these points came from a single study. The removal of these seven points produced the scatter-diagram in Figure 11, which reveals a generally linear shape. The linearity in the scatterplots is support for the adequacy of the logarithmic model to represent these data.

DISCUSSION

Reducing class size has beneficial effects both on cognitive and affective outcomes and on the teaching process itself. These relationships have not in the past been apparent because of an inability to deal with either the class sizes or the effects precisely and quantitatively. Using

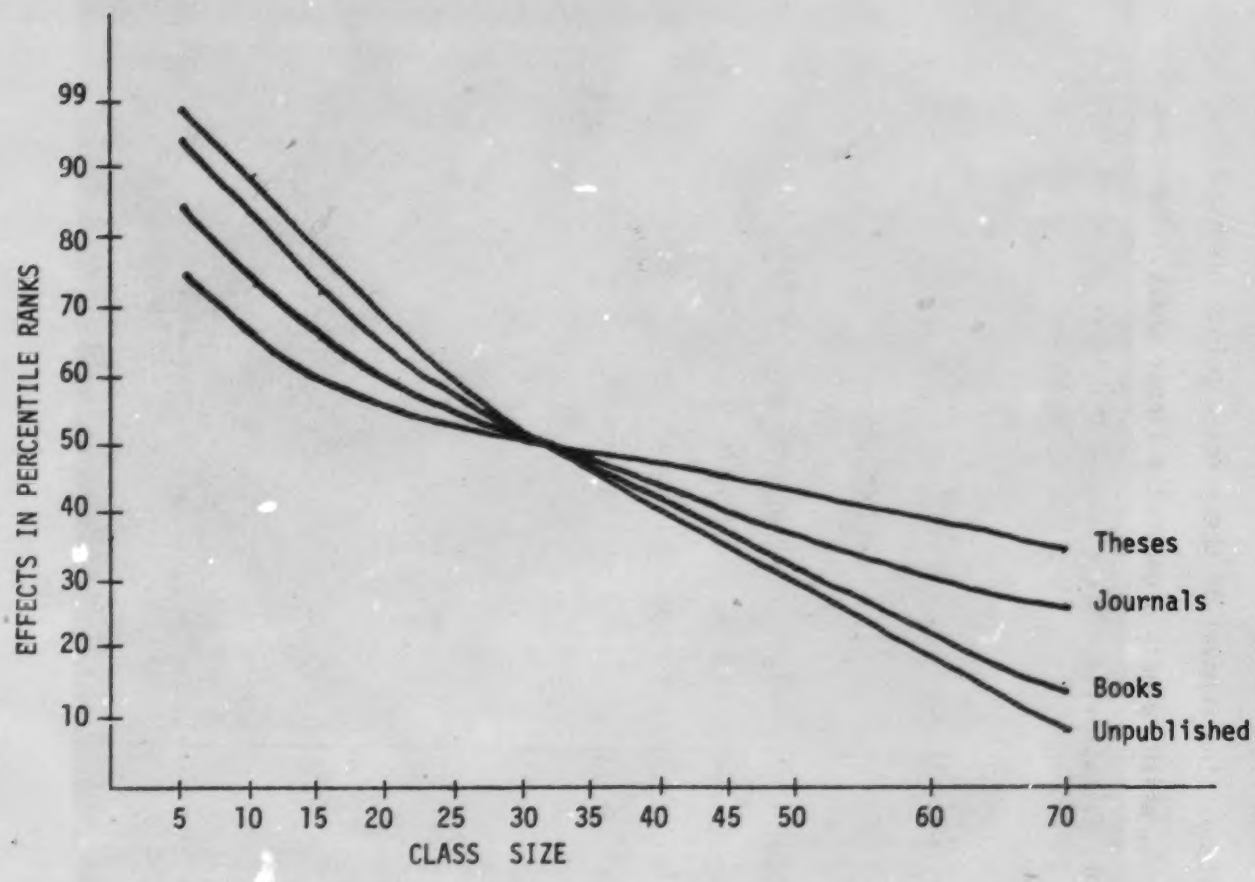


Figure 7. Graph of the relationship of class-size and effects on attitudes and instruction for four sources of publication.

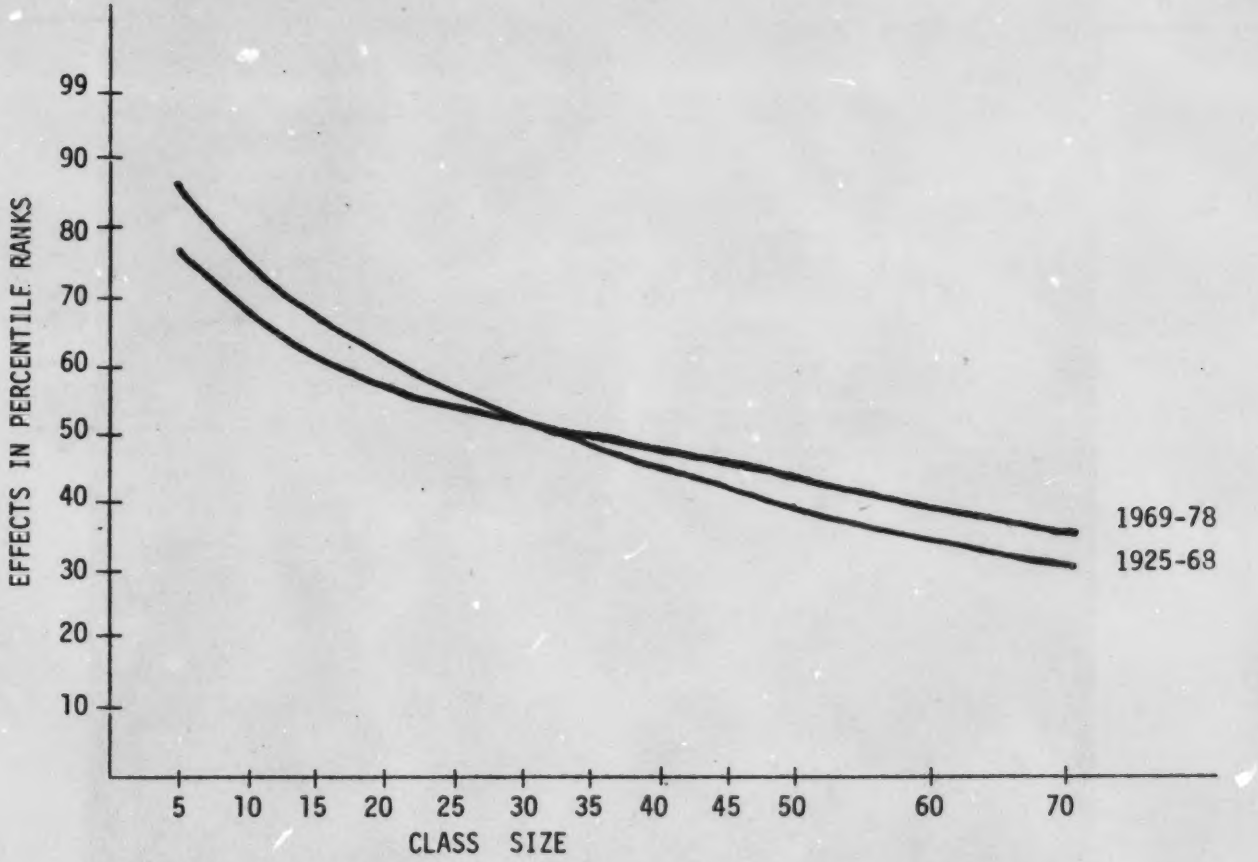


Figure 8. Graph of the relationship of class-size and effects on attitudes and instruction for studies done 1925-1968 and 1969-1978.

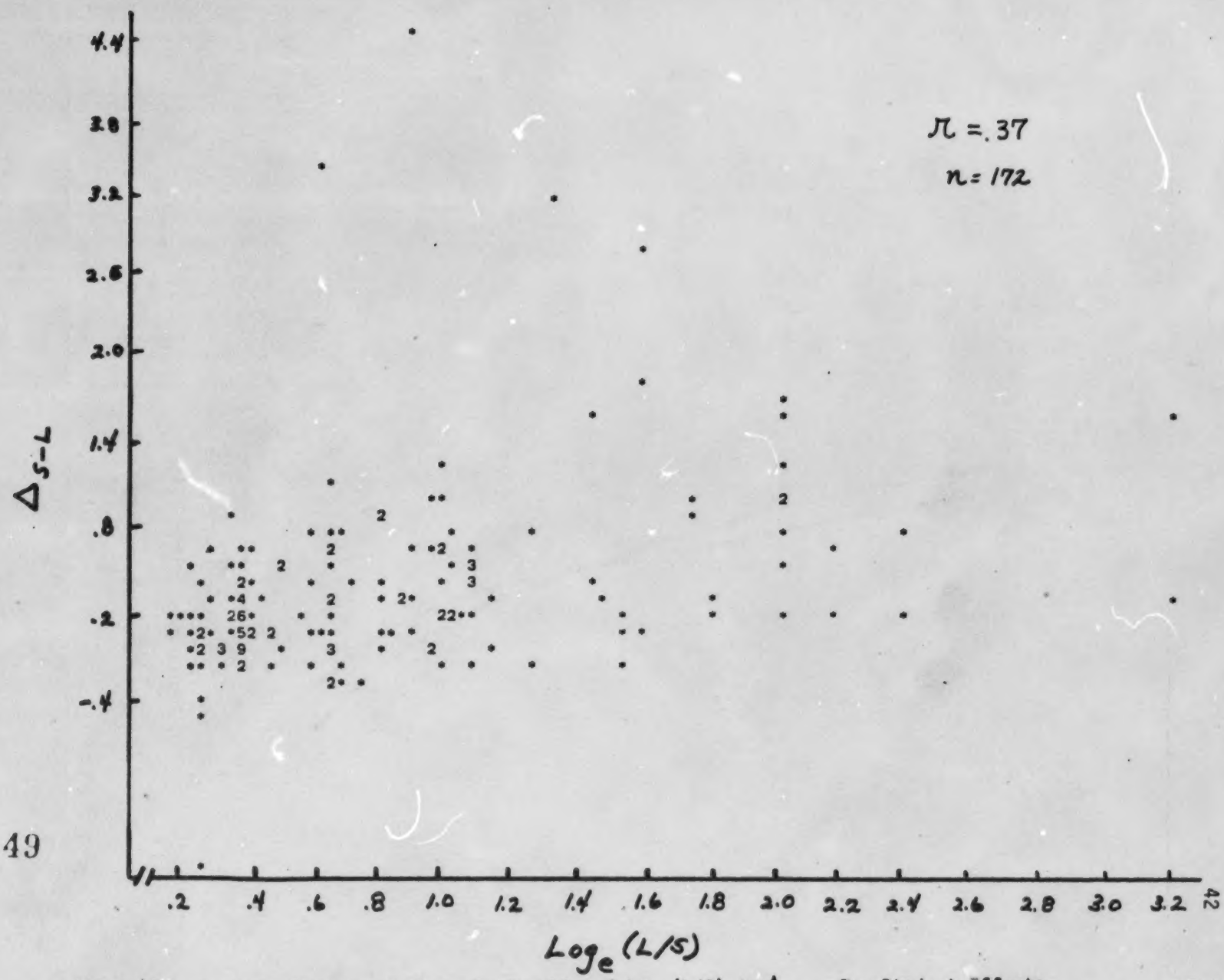


Figure 9. Scatter-diagram of the relationship of $Log_e(L/S)$ to Δ_{S-L} for Student Effects

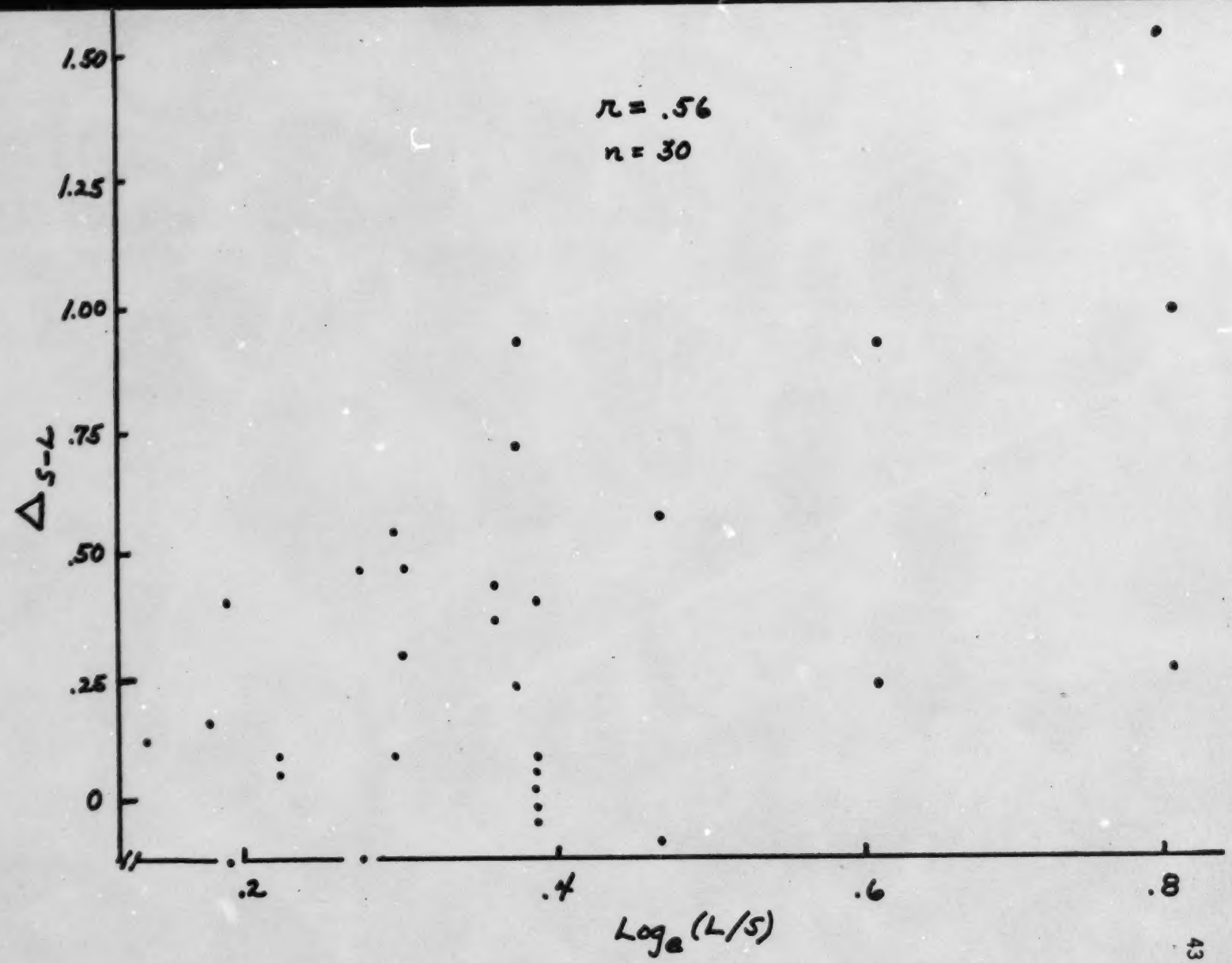


Figure 10. Scatter-diagram of the relationship of $Log_e(L/S)$ to Δ_{S-L} for Teacher Effects

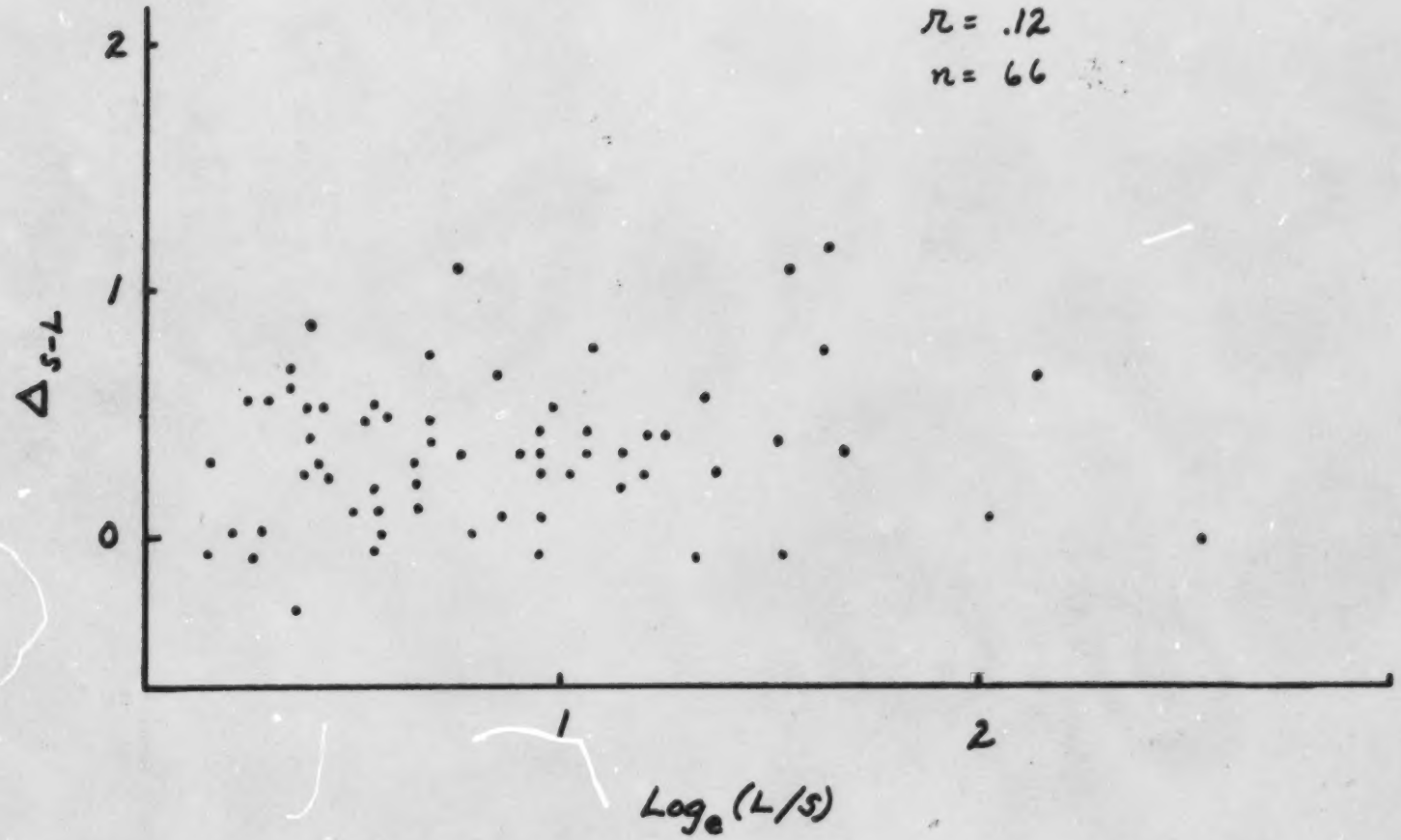


Figure 11. Scatter-diagram of the relationship of $Log_e(L/S)$ to Δ_{S-L} for Instructional Effects

meta-analysis permits us to unravel the complexity and reveal the small but consistent effects of class-size.

In the achievement study it was shown that more than 30 percentile ranks exist between the achievement of a pupil taught individually and a pupil taught in a class of 40. In the study reported here the difference in the quality of the educational environment between a class size of 1 and a class size of 40 is 46 percentile ranks.

The class-size effect is positive, no matter how that effect was measured. The most dramatic effects were those relating to teachers, smaller but still substantial were affective effects on pupils and effects on the instructional process. The class-size effects were related to age of pupils, with effects most notable for children 12 years and under, and least apparent for pupils 18 or over.

Some features of the study interacted with the class-size effect. Well-controlled studies produced slightly smaller class-size effects than uncontrolled studies. Some readers will want to adjust downward their mental estimate of class-size effects. But the difference in effects produced between the two sets of studies amounts to only about 10 percentile ranks even at the extreme points (less than 5 or more than 50 pupils) of the class-size scale. Studies completed before 1968 produced slightly higher class-size effects. Studies gleaned from dissertations produced smaller class-size effects than studies from other sources.

Even with these few qualifications made, one may still have confidence that class size is related to pupil and teacher affect and instructional processes.

Class size affects the quality of the classroom environment. In a smaller class there are more opportunities to adapt learning programs to the needs of individuals. Many teachers avail themselves of these opportunities; others would need training to do so. Chances are good that the climate is friendlier and more conducive to learning. Students are more directly and personally involved in learning.

Class size affects pupils' attitudes, either as a function of better performance or contributing to it. In smaller classes, pupils have more interest in learning. Perhaps there is less distraction. There seems to be less apathy, friction, frustration.

Class size affects teachers. In smaller classes their morale is better; they like their pupils better, have time to plan, diversify; are more satisfied with their performance. Does this mean that class size is merely a selfish, political issue for teachers? Or is the happier teacher the one who performs better? This we cannot unravel, except to cite the other evidence--that the smaller the class is the greater is the effect on the instructional process, on pupil affect, and on achievement.

REFERENCES

Barton, M. A. and Glass, G. V. Integrating studies that have quantitative independent variables. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco. 10 April 1979.

Glass, G. V. Integrating Findings: The meta-analysis of research. Review of Research In Education, 1978, 5, 351-379.

Glass, G. V and Smith, M. L. Meta-analysis of Research on the Relationship of Class Size and Achievement. San Francisco: Far West Laboratory for Educational Research and Development, 1978, (No. OB-NIE-G-78-0103, Dr. L. S. Cahen, Project Director).

Glass, G. V and Smith, M. L. Meta-analysis of the research on class size and achievement. Educational Evaluation and Policy Analysis, 1979, 1, 2-16.

Ryan, D. W. and Greenfield, T. B. The Class Size Question. Toronto, Ontario: The Ministry of Education, 1975.

Sagness, R. Research evidence regarding the impact of class size on pupil academic achievement. Unpublished report. Maricopa County, South Dakota: Maricopa County School Superintendent's Office, undated.

BIBLIOGRAPHY OF STUDIES

	Study ID No.
Baker, L. H. Class size does make a difference. The Nation's Schools, 1936, 17, 27-28.	54
Binion, Stuart, An analysis of the relationship of pupil-teacher ratio to school quality. Doctoral dissertation, Teachers College, Columbia University, 1954.	48
Bjarnson, L. Relation of class size to control of attention. The Elementary School Journal, 1925, 36-41.	46
Bolander, Steven F. "Class Size and Levels of Student Motivation." The Journal of Experimental Education, 1973, Vol. 42, p. 12-17.	11
Capraro, T. C. A study of the effects of class size, supervisory status, and two-way communication upon learning and attitudes of AFROTC cadets in a closed-circuit instructional television program. Unpublished doctoral dissertation, Pennsylvania State University, 1956.	44
Carlberg, C. and Harms, N. Evaluation of Englewood Public Schools. Boulder, Colorado: Laboratory of Educational Research, University of Colorado, 1977.	52
Christensen, J. J. The effects of varying class size and teaching procedures on certain levels of student learning. Unpublished doctoral dissertation, Washington State University, 1960.	25
Coble, H. M. An analysis of the relationship between selected classroom variables and a criterion score obtained on Indicators of Quality. Ed. D. dissertation, Teachers College, Columbia, 1969.	53
Coleman, J. S et al. Equality of Educational Opportunity. Washington: U. S. Government Printing Office, 1966.	50
Cram, B. M. An investigation of the influence of class size upon academic attainment and student satisfaction. Arizona State University, Ed.D. dissertation, 1968. 68-14,988.	22
Dawe, H. C. The influence of size of kindergarten group upon performance. Child Development, 1934, 5. 295-303.	15
DeCecco, John P. "Class Size and Co-ordinated Instruction." British Journal of Educational Psychology, Feb. 1964, Vol. 34, p. 65-74.	19
Draves, D. D. A study of class size and instructional methods. Unpublished doctoral dissertation, University of Wisconsin, 1957.	24

Driscoll, J. P. The comparative effectiveness of high and low degrees of verbal reinforcement of concepts in a survey course in education utilizing two class sizes. Unpublished doctoral dissertation, Pennsylvania State University, 1957. 3857

Feldhusen, J. F. The effects of small and large group instruction on learning of subject matter, attitudes and interests. Journal of Psychology, 1963, 55, 357-362. 13

Fox, D. J. Expansion of the More Effective School Program. New York: Center for Urban Education, 1967. 01

Gansneder, B. M., Strzepek, J., and Caritj, W. Relationships between teaching load and selected factors. Virginia English Bulletin, 1978, 28, 46-50. 51

Goldstein, H., Moss, J. W., and Jordan, L. J. The efficacy of special class training on the development of mentally retarded children. Cooperative Research Project #619. Urbana, Illinois: Institute for Research on Exceptional Children, University of Illinois, 1964. 07

Grove, P. W. The effect of varied-sized classes in an eleventh grade United States history course. Unpublished doctoral dissertation, Pennsylvania State University, 1969. 40

Haberman, M. and Larson, R. O. Would cutting class size change instruction? The National Elementary Principal, 1968, 47, 18-19. 47

Haskell, S. Some observations on the effects of class size upon pupil achievement in geometrical drawing. Journal of Education Research, 1964, 58, 27-30. 14

Hawkins, W. and Taylor, S. Teacher reactive behavior related to class size and to the teaching of mathematics, social studies, and English. Paper presented at the meeting of the Australian Association for Research in Education, Canberra, November 1972. 3772

Holland, John B. "The Image of the Instructor as it is Related to Class Size." Journal of Experimental Education, December 1954, Vol. 23, p. 171-177. 09

Hoover, K. H., Baumann, V. H. and Shafer, S. M. The influence of class-size variations on cognitive and affective learning of college freshmen. Journal of Experimental Education, 1970, 38, 39-43. 16

Johnson, L. I. Class size and its relationship to change in the child's self-concept. Unpublished doctoral dissertation, University of Nebraska, 1969. 3869

Lansing, K. M. The effect of class size and room size upon the creative drawings of fifth grade children. Ed.D., Pennsylvania State University, 1956. 19,967. 49

Loos, F. M., Williams K. P. and Bailey, J. S. A multi-element analysis of the effect of teacher aides in an "open"-style classroom. Journal of Applied Behavior Analysis, 1977, 10, 437-448. 56

Lundberg, L. D. "Effects of Smaller Classes." The Nation's Schools, May 1947, Vol. 39, p. 20-22. 20

Manos, P. G. Relationships among class size, selected school and teacher characteristics and reading improvement made by low-achieving Grade 4 pupils. Wayne State, 1974. 28

Mayeske, G. W. et al. A Study of Our Nation's Schools. U.S. Office of Education, 1970. 45

McConkie, G. W. Relation of selected factors to class size of kindergarten groups. Unpublished master's thesis, University of Utah, 1955. 02

McKenna, B. H. Measures of class size and numerical staff adequacy related to a measure of school quality. Unpublished doctoral dissertation, Teachers College, Columbia, 1955. 61

Metzner, Alice B. and Berry, Charles S. "Size of Class for Mentally Retarded Children." Training School Bulletin, 1926, Vol. 23, p. 241-251. 12

Miglionica, M. Benedetta. A study of differences and relationships between educational achievement and class size in 26 selected high schools in the archdiocese by Los Angeles. Unpublished Ed.D. dissertation, University of Southern California, 1958. 29

Meiller, R. D. The teaching of biology and physical science in large and small groups in Arlington High School, Arlington, Illinois. Unpublished doctoral dissertation, Colorado State College, 1965. 27

Newell, C. A. Class Size and Adaptability. New York: Teachers College, Columbia University Bureau of Publications, 1943. 04

Olson, M. N. Research Notes: Ways to achieve quality in school classrooms: some definitive answers. Phi Delta Kappan, 1971, 63-65. 59

Oomens, F. W. Effect of group size on achievement in agricultural mechanics. Unpublished doctoral dissertation, University of Missouri, 1971. 42

Otto, H. J. Class size factors in elementary schools. Bureau of Laboratory Schools Publication No. 4., Austin: University of Texas, 1954. 10

Passarella, L. A. The relationship of class size to teachers' perceptions of their own educational effectiveness. Unpublished doctoral dissertation, Rutgers University, 1977. 39

Pertsch, C. Frederick. Some effects of class size on the educational program in New York city elementary schools. The Advancing Front of Education. Eighth Yearbook, New York Society for the Experimental Study of Education. New York: Thesis Publishing Co. 1943, p. 3-21. 57

Pugh, J. B. Performance of Pupils and Teachers in Small Classes. N.Y.: Metropolitan School Study Council, Teachers College, Columbia University, 1965. 06

Richman, Harold. Educational practices as affected by class size. Unpublished Ed.D. dissertation, Teachers College, Columbia University, 1955. 55

Rivera, L. R. D. The effects of increasing class size on achievement and the reactions of students and faculty toward this practice at the Catholic University of Puerto Rico. Unpublished doctoral dissertation, Lehigh University, 1976. 3776

Scott, James L. The effect of class size on student verbal interaction in five English classes. Unpublished doctoral dissertation, Rutgers University, 1972. 33

Shapson. S. M., Wright, E. N., Eason, G. and Fitzgerald, J. Results of an experimental study of the effects of class size. Presented at the American Educational Research Association, March, 1978, Toronto. 78

Siegel, L., Macomber, F. G. and Adams, J. F. The effectiveness of large group instruction at the university level. Harvard Educational Review, 1959, 29, 216-226. 17

Smith, A. R. The effects of instructional group size on the verbal behavior of junior high science teachers. Unpublished doctoral dissertation, University of Pennsylvania, 1975. 34

Smith, D. I. Effectes of class size and individualized instruction on the writing of high school juniors. Unpublished doctoral dissertation, Florida State University, 1974. 43

Smith, Dora U. Class Size in High School English. Minneapolis: The University of Minnesota Press, 1925. 21

Stephens, L. D. A study of the relative effects of selected teaching procedures relating to differential class size on the attainment of objectives in an introductory survey education course. Unpublished doctoral dissertation, University of Miami, 1964. 23

Stephens, L. and Berryman, C. The effects of class size and instructional methods on attitudes toward the teaching profession. Contemporary Education, 1968, 40, 76-78. 08

Takanishi-Knowles, R. N. Relationships among instructional group size, student engagement, and teacher strategies. Unpublished doctoral dissertation, Stanford University, 1973. 36

Taylor, D. B. and Fleming, M. More Effective Schools Program, Disadvantaged Pupil Program Fund, Fund Number 97-16, 1971-1972 Evaluation (Year 3). Ohio: Cleveland Public Schools, Division of Research and Development, 1972. 03

Walberg, H. J. Class size and the social environment of learning. Human Relations, 1969, 22, 465-475. 60

Ward, W. H. A test of the association of class size to students' attitudes toward science. Journal of Research on Science Teaching, 1976, 13, 137-143. 35

Weitzman, D. L. Effect of tutoring on performance and motivation ratings in secondary school students. California Jouranl of Educational Research, 1965, 16, 108-115. 18

Welch, W. W. Evaluating the small group as a component of modular schedules. 1971 ERIC document ED064216. 32

Whitsitt, R. C. Comparing the individualities of large secondary school classes with small secondary school classes through the use of a structured observation schedule. Unpublished Ed.D. dissertation, Teachers College, Columbia University, 1955. 58

Williams, C. M. An exploratory investigation of the effects of class size and scheduling related to achievement and motivational outcomes. Unpublished doctoral dissertation, Michigan State University, 1962. 41

Integrating Studies That Have Quantitative Independent Variables*

Mark A. Barton
Gene V Glass

Laboratory of Educational Research
University of Colorado

Some types of research study have both dependent, Y, and independent, X, variables that can be quantitatively measured, e.g., amount of reinforcement (independent) and time-to-criterion (dependent), engaged study time (independent) and learning (dependent), or class-size (independent) and achievement (dependent). One desires a technique for integrating many separate studies into an aggregate description of the relationship between the two quantitative variables. The search for such a technique encounters two complications: 1) the values of the independent variables observed in a study may be quite different, and 2) the scales of measurement (mean and variance) of the dependent variables may be quite different as well.

The second complication can be resolved readily. The dependent variable difference in the study between independent variable values X_1 and X_2 can be standardized via

$$\Delta_{X_1-X_2} = \frac{\bar{X}_1-\bar{X}_2}{\hat{\sigma}} \quad \text{, where } \hat{\sigma} \text{ is an} \qquad (1)$$

assumed homogeneous within-group standard deviation.

However, the first complication is more problematic. That no two studies need include the same values of X_1 and X_2 makes the representation of the X and Y relationship very complex. This is so in part because Δ is a differential, not a measure on a scale with a non-arbitrary zero point.

---

*This paper was produced under a grant from the National Institute of Education (#NIE-G-78-0148) entitled "Methods of Integrative Analysis," and delivered at the Annual Meeting of the American Educational Research Association, San Francisco: April 1979.

One solution to the problem of depicting the $\underline{X}$ and $\underline{Y}$ relationship is to regress Δ onto $\underline{X}_1$ and $\underline{X}_2$ in a three-dimensional space. (An extension of this approach was used by Glass and Smith (1979) in their study on class-size and achievement.) The major drawback of this solution is that the relationship among two variables has been complicated by expression as a relationship among three variables; thus it is inaccessible to many who can comprehend a simple graph but not a complex one. Moreover, in reducing the three-dimensionsal relationship to two dimensions by imposing restrictions (Glass and Smith, 1979), the mathematics grows complicated and attendant problems of statistical inference are obscured.

A simpler solution is desirable, and one or two have been found.

A Logarithmic Model

Consider an illustration from research on class-size and achievement. Fourteen experiments were found in which pupils were randomly assigned to classes of different sizes. These fourteen studies yielded over 100 separate comparisons of achievement in smaller and larger classes. The multiplicity of findings is due partly to the fact that in one study there may exist several pairs of class sizes and partly to the fact that a single pair of class sizes may have been measured on more than one achievement test. The latter multiplicity was averaged out and the former retained in the summary of 30 data points in Table 1.

One might expect class-size and achievement to be related in something of an exponential or geometric fashion--reasoning that one pupil with one teacher learns some amount, two pupils learn less, three pupils learn still less, and so on. Furthermore, the drop in learning from one to two pupils could be expected to be larger than the drop from two to three, which in turn

Table 1

Data on the Relationship of Class-size and Achievement from Studies Using Random Assignment of Pupils. (Outcomes scaled via formula (1), with $\hat{\sigma}=(s_L+s_S)/2$.)

Study Number	Size of Larger Class	Size of Smaller Class	Δ_{S-L}
1.	1.	25.	.32
2.	1.	3.	.22
2.	1.	25.	1.52
2.	3.	25.	1.22
3.	17.	35.	-.29
4.	28.	112.	-.03
5.	1.	2.	.36
5.	1.	5.	.52
5.	1.	23.	.83
5.	2.	5.	.22
5.	2.	23.	.57
5.	5.	23.	.31
6.	15.	30.	.17
7.	16.	23.	.05
7.	16.	30.	.04
7.	16.	37.	.08
7.	23.	30.	.04
7.	23.	37.	.04
7.	30.	37.	0
8.	20.	28.	.15
9.	26.	50.	.29
10.	1.	32.	.65
11.	15.	37.	.40
11.	15.	60.	1.25
11.	37.	60.	.65
12.	1.	8.	.30
13.	15.	45.	.07
14.	1.	14.	.72
14.	1.	30.	.78
14.	14.	30.	.17

$$\Delta_{S-L} = \frac{\bar{X}_S - \bar{X}_L}{(s_S + s_L)/2}$$

n = 14 studies

N = 30 comparisons

is probably larger than the drop from three to four, and so on. A logarithmic curve represents one such relationship:

$$y = \alpha - \beta \log_e C + \varepsilon, \text{ where} \qquad (2)$$

C denotes class-size.

In formula (2), α represents the achievement for a "class" of one person, since $\log_e 1 = 0$, and β represents the speed of decrease in achievement as a class-size increases. The general curve is graphed in Figure 1.

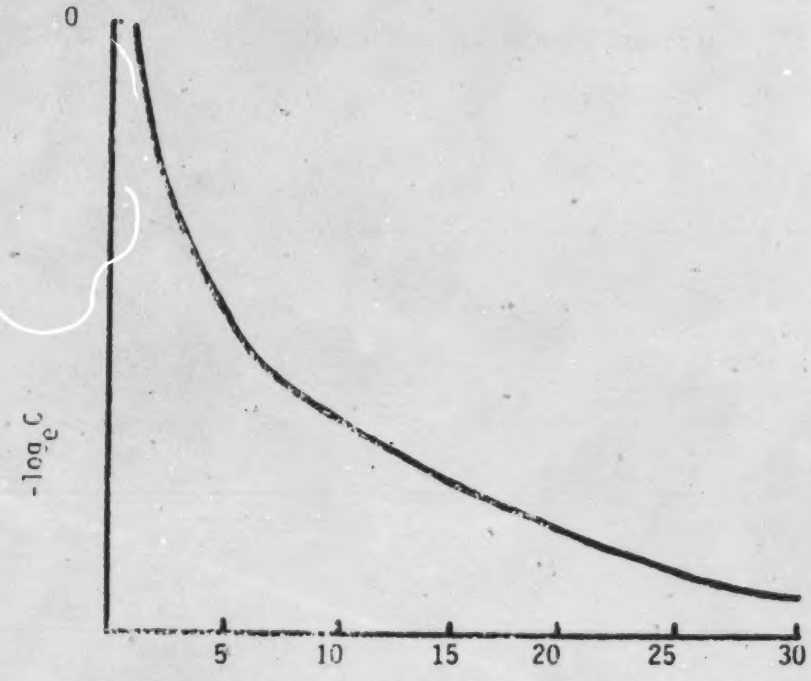


Figure 1. Graph of the log curve for the model in formula (2).

Formula (2) can not be fitted to data directly because Y is not measured on a common scale across studies. This problem can be circumvented by calculating Δ_{S-L} for each comparison of a smaller and a larger class within a study. Then, from formulas (1) and (2) one has

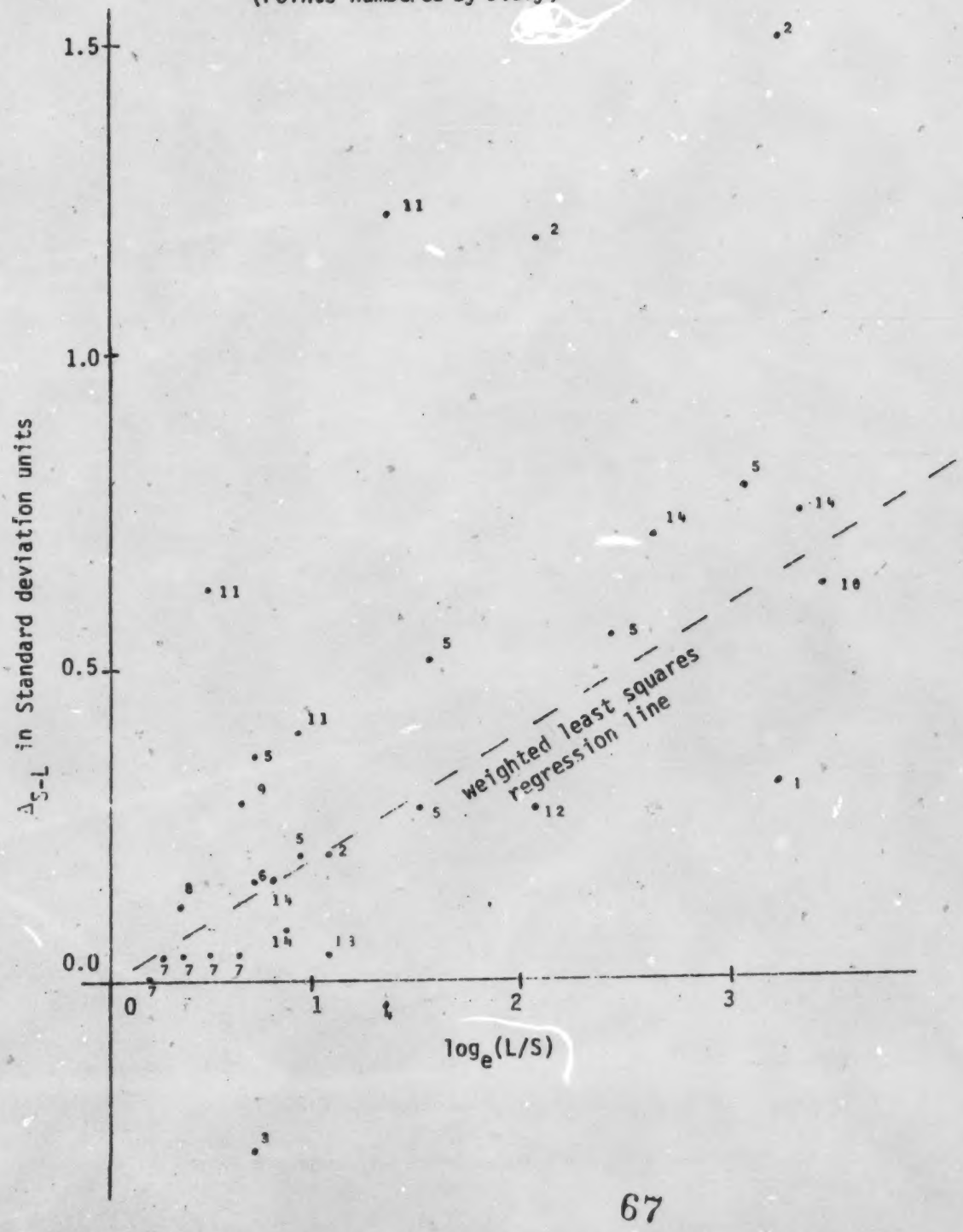
$$\begin{aligned}\Delta_{S-L} &= (\alpha - \beta \log_e S + \varepsilon_1) - (\alpha - \beta \log_e L + \varepsilon_2) \\ &= \beta(\log_e L - \log_e S) + \varepsilon_1 - \varepsilon_2 \\ &= \beta \log_e(L/S) + \varepsilon. \qquad (3)\end{aligned}$$

The model in formula (3) is particularly simple and straightforward. The values of Δ_{S-L} are merely regressed onto the logarithm of the ratio of the larger to the smaller class-size, forcing the least-squares regression line through the origin.

Figure 3

Scatter Diagram of Δ_{S-L}

Graphed Against Log_e (L/S).
(Points numbered by study)



$$\hat{\beta} = \frac{\Sigma(\Delta_{S-L})(\log_e L/S)}{\Sigma(\log_e L/S)^2}.$$

A scatter diagram of the data in Table 1 appears as Figure 2, in which Δ_{S-L} is graphed against $\log_e(L/S)$. The estimate of β for these data equals 0.27. The value of r is .64, and r^2 = .42. The resulting curve relating class-size C to achievement in standard-score units appears as Figure 3.

One can either weight each Δ_{S-L} in Table 1 equally in deriving an estimate of β, or it can be reasoned that each of the fourteen studies should receive equal weight so that each Δ_{S-L} is multiplied by $2/(k^2-k)$ when it is derived from a study involving k different class-sizes. The estimate of β from the regression involving weighted Δ's is equal to 0.21, which agrees closely with the earlier result.

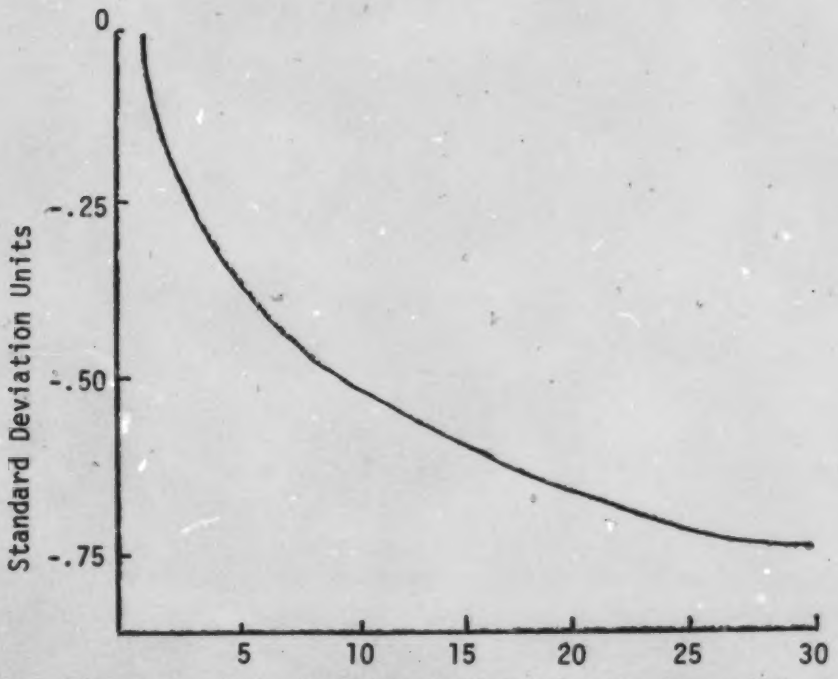


Figure 3. Data in Table 1 fitted to the log model of formula (2).

An Alternative Log Model.

A model may have advantages if it avoids highly interdependent data sets created (as in the first model) by taking all pairwise differences in a study. Such an alternative model can be developed along the following lines.

Let $\bar{y}_c$ and s_c be the mean and standard deviation of the dependent variable for class-size C in one of m studies. For the k class-sizes in a particular study, order the groups from $C_1 < C_2 \ldots < C_k$. Arbitrarily set

$$\delta_k = 0 \text{ ; then}$$

$$\delta_{k-1} = \frac{\bar{y}_{k-1} - \bar{y}_k}{(s_{k-1} + s_k)/2} ,$$

$$\delta_{k-2} = \delta_{k-1} + \frac{\bar{y}_{k-2} - \bar{y}_{k-1}}{(s_{k-2} + s_{k-1})/2} ,$$

$$\delta_{k-3} = \delta_{k-2} + \frac{\bar{y}_{k-3} - \bar{y}_{k-2}}{(s_{k-3} + s_{k-2})/2} \text{ , and so on.} \qquad (4)$$

The data from the fourteen class-size experiments have been scaled via formula (4) and are recorded in Table 2.

The following model can be postulated for data of the form in (4):

$$\delta = -\beta \log_e C + (\alpha_1 D_1 + \ldots + \alpha_m D_m) + \varepsilon . \qquad (5)$$

The $\alpha \cdot D$ terms in (5) represent dummy variables and arbitrary level parameters for the m separate studies; $D_i = 1$ if a δ in question comes from the ith study, and it equals zero otherwise. The parameters β and $(\alpha_1, \ldots, \alpha_m)$ can be estimated by regressing δ onto $\log_e C$. We have done so for the data in Table 2 and obtained a weighted least-squares estimate of β equal to 0.22. The estimates of the α's are unimportant. In this regression, each δ was

Table 2

Data on the Relationship of Class-size and Achievement from Studies Using Random Assignment of Pupils. (Outcomes scaled via Formula (4).)

Study Number	C, Size of Class	δ_c
1.	1.	.32
1.	25.	0
2.	1.	1.44
2.	3.	1.22
2.	25.	0
3.	17.	-.29
3.	35.	0
4.	28.	-.03
4.	112.	0
5.	1.	.89
5.	2.	.53
5.	5.	.31
5.	23.	0
6.	15.	.17
6.	30.	0
7.	16.	.09
7.	23.	.04
7.	30.	0
7.	37.	0
8.	20.	.15
8.	28.	0
9.	26.	.29
9.	50.	0
10.	1.	.65
10.	32.	0
11.	15.	1.05
11.	37.	.65
11.	60.	0
12.	1.	.30
12.	8.	0
13.	15.	.07
13.	45.	0
14.	1.	.95
14.	14.	.17
14.	30.	0

weighted by k^{-1} so that each of the 14 studies would receive equal weight. The result is virtually identical to that obtained for the model in (3).

The model in (5) is more general and of more significance than the model in (3). Model (5) can be applied in a wide range of circumstances in which studies with quantitative independent variables are integrated. The first log term in (5) can be replaced by any mathematical function appropriate to

a particular application. The important point about model (5) is that it simultaneously resolves the problems presented by different scales of measurement of $\underline{Y}$ and different values of $\underline{X}$ compared across studies.

Postscript

Estimating parameters of models in (3) and (5) is just the beginning of full data analyses aimed at integrating sets of studies with quantitative independent variables. Now residuals should be calculated, inspected and the models altered if trends in the residuals are observed.

We intend to compare the inferential properties of the models via jackknife methods to determine whether one has an advantage. It is unlikely that one is to be preferred to the other on grounds of better fit to the data; a proof of this fact may be possible.

REFERENCE

Glass, G.V and Smith, M.L. Meta-analysis of research on the relationship of class-size and achievement. Evaluation and Policy Analysis, 1979, 1, (in press).

```
FILE NAME       CLASS SIZE PHASE TWO
VARIABLE LIST   V1 TO V37
INPUT MEDIUM    CARD
INPUT FORMAT    FIXED(4F2.0,4F1.0,F4.0,F3.0,F1.0,F5.0,3F3.0,F1.0,F5.0,3F3.0,3F1.0
                ,F2.0,F1.0,2F2.0,3F1.0,2F2.0,F4.0,F1.0,2X,F1.0,F2.0,F4.2)
N OF CASES      371
COMPUTE         LS=V20/V15
COMPUTE         LOGLS=LN(LS)
COMPUTE         VARZ=V37*LOGLS
COMPUTE         VARY=LOGLS**2
COMMENT         THIS IS THE CORRECT RECODING OF SMITH SYSTEM ONE WHERE ONE IS
                STUDENT EFFECTS, TWO IS TEACHER EFFECTS, AND THREE IS INSTRUCTION
                AL EFFECTS
RECODE          V33 (0101 THRU 0108,0301,0304 THRU 0307,0309 THRU 0312,0403,0502
                THRU 0508,0511 THRU 0513,0601,0602,0605=1)(0803,0901 THRU 0903,
                0905 THRU 0907=2)(0201 THRU 0209,0401,0402,0308,0501,0509,0510,
                0603,0604,0701 THRU 0705,0801,0802,0804 THRU 0809,0904,1001 THRU
                1003=3)
VAR LABELS      V1,STUDY ID/
                V2,COMPARISON ID/
                V3,OUTCOME ID/
                V4,YEAR OF STUDY/
                V5,SOURCE OF STUDY/
                V6,TYPE OF STUDY/
                V7,COUNTRY OF ORIGON/
                V8,SUBJECT TAUGHT/
                V9,HOURS OF INSTRUCTION/
                V10,WEEKS OF INSTUCTION/
                V11,SUPPLEMENTAL OF INTEGRAL INSTRUCTION/
                V12,N OF PUPILS IN SMALL CLASS/
                V13,N OF GROUPS IN SMALL CLASS/
                V14,N OF INSTRUCTORS IN SMALL CLASS/
                V15,PUPIL INSTRUCTOR RATIO IN SMALL CLASS/
                V16,ACCURACY OF ESTIMATE IN SMALL CLASS/
                V17,N OF PUPILS IN LARGE CLASS/
                V18,N OF GROUPS IN LARGE CLASS/
                V19,N OF INSTRUCTORS IN LARGE CLASS/
                V20,PUPIL INSTRUCTOR RATIO IN LARGE CLASS/
                V21,ACCURACY OF ESTIMATE IN LARGE CLASS/
                V22,INSTRUCTOR TYPE/
                V23,SEX OF TEACHER/
                V24,YEARS OF TEACHING EXPERIENCE/
                V25,PUPIL ABILITY/
                V26,PERCENT FEMALE PUPILS/
                V27,AVERAGE AGE OF PUPILS/
                V28,STUDY SETTING/
                V29,ASSIGNMENT OF PUPILS TO GROUPS/
                V30,ASSIGNMENT OF TEACHERS TO GROUPS/
                V31,PERCENT ATTRITION IN SMALL GROUP/
                V32,PERCENT ATTRITION IN LARGE GROUP/
                V33,DOMAIN OF OUTCOME/
                V34,OUTCOME CLASS/
                V35,METRIC OF MEASURE/
                V36,FOLLOWUP TIME/
                V37,DELTA/
VALUE LABELS    V5 (1)JOURNAL (2)BOOK (3)THESIS (4)UNPUBLISHED/
                V29 TO V30 (1)RANDOM (2)MATCHED (3)REPEATED MEASURES (4)UNCONTROL
                LED/
                V35 (1)GAIN SCORES (2)RESIDUALIZED GAINS (3)UNCORRECTED (4)PERCEN
                TAGES (5)CORRELATIONS/
                V6 (1)CLASS SIZE (2)ABILITY GROUPING (3)TUTORING (4)PSYCHOLOGICAL
                EXPERIMENT (5)SECONDARY ANALYSIS (6)OTHER/
```

```
                V7 (1)USA (2)CANADA (3)AUSTRALIA (4)BRITAIN (5)OTHER/
                V8 (1)READING (2)MATH (3)LANGUAGE (4)ALL (5)ENGLISH OR WRITING
                (6)SOCIAL STUDIES (7)EDUCATION (8)OTHER (9)SCIENCE/
                V11 (1)SUPPLEMENTAL (2)INTEGRAL/
                V16 (1)LOW (2)MEDIUM (3)HIGH/
                V21 (1)LOW (2)MEDIUM (3)HIGH/
                V22 (1)REGULAR TEACHER (2)ADULT AIDES OR TUTORS (3)BOTH/
                V23 (1)MALE (2) FEMALE/
                V24 (1)BELOW 90 (2)90 TO 110 (3) ABOVE 110/
                V28 (1)REGULAR CLASSROOM (2)EXPERIMENTAL SETTING/
MISSING VALUE  V1 TO V37(BLANK)
READ INPUT DATA
430102743113  50 122  150      151  150  6  6 2511 1325016113     0202   100-231
430102743113  50 122  150      151  150  6  6 2511 1325016113     0804   400 -36
4801015431146000 322           201           * 3011   2    144   0701   200  46
47010168   4      2  900 79 79  91  900 79 79 2811   1   9144   0301   400 -12
06010465 1146000 352 1620 90 90 182 2790 90 90 3121   25012144   0205   400  56
06010465 1146000 352 1620 90 90 182 2790 90 90 3121   25012144   0203   400  39
06010465 1146000 352 1620 90 90 182 2790 90 90 3121   25012144   0207   400  65
06010465 1146000 352 1620 90 90 182 2790 90 90 3121   25012144   0202   400  52
070104644414       2   57  4  4 152   69 35 35 3011   150 811420 50104   300  41
070104644414       2   57  4  4 152   69 35 35 3011   150 811420 0605    300 -01
070104644414       2   57  4  4 152   69 35 35 3011   150 811420 0401    300  42
070104644414       2   57  4  4 152   69 35 35 3011   150 811420 0508          0
11010473111   45 151   60  5  5 123  175  5  5 3531   35019 2210140106   300  91
11010473111   45 151   60  5  5 123  175  5  5 3531   35019 2210140603   300  87
11010473111   45 151   60  5  5 123  175  5  5 3531   35019 2210140604   300  95
11010473111   45 151   60  5  5 123  175  5  5 3531   35019 2210140804   300  78
140101641112  60 122   33  2  2 173   69  2  2 3531   3  16113   0102    300 -10
130103631117  50 182   28  1  1 283   22  1  1 7231      19123   0105    300  18
130103631117  50 182   28  1  1 283   22  1  1 7231      19123   0105    300  36
130103631117  50 182   28  1  1 283   22  1  1 7231      19123   0804    300  06
210103312115 175 352   40  2  2 203  102  2  2 5111   3  14123   0201    400  39
210103312115 175 352   40  2  2 203  102  2  2 5111   3  14123   0301    300 442
210103312115 175 352   40  2  2 203  102  2  2 5111   3  14123   0301    300  77
200101471114 360 182           303           3731   25010143   0306    400  24
190102641118  54 182  163  6  4 281  224  2  211211   3  18113   0804    300  43
190102641118  54 182  163  6  4 281  224  2  211211   3  18113   0804    300  11
180102  1318  32 161   25  6  6  41   25  1  1 2512   024016124  0106     00  98
180102  1318  32 161   25  6  6  41   25  1  1 2512   024016124  0307    400 109
170102591118  50 182   44  2  2 221  301  2  215111   3  19124   0102    300  40
170102591118  50 182   44  2  2 221  301  2  215111   3  19124   0101    300  30
160101701117  50 182  160  6     203  160  3     5531   3  18144   0105    300 000
240104573117  45 151   89  3  3 293  123  2  2 6231   36222144   0303    400  17
240104573117  45 151   89  3  3 293  123  2  2 6231   36222144   0303    400 100
240104573117  45 151   89  3  3 293  123  2  2 6231   36222144   0804    300 101
240104573117  45 151   89  3  3 293  123  2  2 6231   36222144   0802          157
250104603117  20 151   63  7  2 102   27  1  1 27 1  3  20123   0301    400  75
250104603117  20 151   63  7  2 102   27  1  1 27 1  3  20123   0804    300  57
250104603117  20 151   63  7  2 102   27  1  1 27 1  3  20123   0405    300  69
250104603117  20 151   63  7  2 102   27  1  1 27 1  3  20123   0306    400  00
350101761118 150 302  120 10 10 121  123  4  4 2911   2  16144   0102    300  11
380101693I 4 120  4    80 20 20 213   80 20 20 3231   2   6124   0103    200  47
370101724134                  371           671            0308    400  54
270101653118       2  224  8  4 28   417  4  8 522    2  16144   0102    200  51
220101  4118  95 192   77  3  3 26   147  3  3 4921   3  17113   0102    300  15
320102714118       2              61            2811   2  16144   0804    300  41
320102714118       2              61            2811   2  16144   0301    300  36
330103723115   1  11  120100  5 121  120  5  5 2411   2  16133   0304    300   0
330103723115   1  11  120100  5 121  120  5  5 2411   2  16133   0301    300  39
330103723115   1  11  120100  5 121  120  5  5 2411   2  16133   0301    300  27
280102743111 150 302  533 20 20 271 1056 30 30 351    1    144   0306    300-162
```

2801027^3111	150	302	533	20	20	271	1056	30	30	351	1	144	0804	300	-13
3701067o3116	45	152	390	11	11	353	1137	11	1110331		3	19123	0804	300	56
370106763116	45	152	390	11	11	353	1137	11	1110331		3	19123	0102	400	59
370106763116	45	152	390	11	11	353	1137	11	1110331		3	19123	0301	400	29
370106763116	45	152	390	11	11	353	1137	11	1110331		3	19123	0202	400	22
370106763116	45	152	390	11	11	353	1137	11	1110331		3	19123	0602	400	25
370106763116	45	152	390	11	11	353	1137	11	1110331		3	19123	0302	400	30
380101573117	45	152	21	1	1	213	107	1	110731		3	191231	0100105	300	-14
420101713118	17	151	32	16	16	22	32	8	8	421	3	1921	0105	300	-19
4101046231 8	60	302	136	9	9	151	136	2	2	8011	2	17133	0805	400	42
4101046231 8	60	302	136	9	9	151	136	2	2	8011	2	17133	0308	400	231
4101046231 8	60	302	136	9	9	151	136	2	2	8011	2	17133	0301	400	292
4101046231 8	60	302	136	9	9	151	136	2	2	8011	2	17133	0309	400	189
440101563118		3	236	4	4	251	115	2	2	45111	30019214		0804	400	0
440201563118		3	236	4	4	25	78	1	1	78111	30019214		0804	400	20
440301563118		3	236	4	4	25	114	1	1114111		30019214		0804	400	-14
440401563118		3	115	2	2	45	78	1	1	78111	30019214		0804	400	20
440501563118		3	115	2	2	45	114	1	1114111		30019214		0804	400	-14
440601563118		3	78	1	1	78	114	1	1114111		30019214		0804	400	-39
490101563118			20	2	2	10	52	2	2	26111	2	10143	0202	300	48
490201563118			20	2	2	10	100	2	2	5111	2	10143	0202	300	81
490301563118			52	2	2	26	100	2	2	5111	2	10143	0202	300	34
390102773114	960	322	1995	95	95	212	1300	52	52	2521	2	8144	0901	3	-13
390102773114	960	322	1995	95	95	212	1300	52	52	2521	2	8144	0903		47
390202773114	960	322	1300	52	52	252	2968106106			2821	2	8144	0901		22
390202773114	960	322	1300	52	52	252	2968106106			2821	2	8144	0903		13
390302773114	960	322	1995	95	95	212	2968106106			2821	2	8144	0901		09
390302773114	960	322	1995	95	95	212	2968106106			2821	2	8144	0903		60
400112693116	118	30	80	8	8	102	310	10	10	3111	3	17124	0102	400	52
400112693116	118	30	80	8	8	102	310	10	10	3111	3	17124	0301	400	71
400112693116	118	30	80	8	8	102	310	10	10	3111	3	17124	0301	400	45
400112693116	118	30	80	8	8	102	310	10	10	3111	3	17124	0604	400	54
400112693116	118	30	80	8	8	102	310	10	10	3111	3	17124	0208	400	50
400112693116	118	30	80	8	8	102	310	10	10	3111	3	17124	0808	400	39
400212693116	118	30	80	8	8	102	310	10	10	3111	3	17124	0309	400	25
400212693116	118	30	80	8	8	102	310	10	10	3111	3	17124	0301	400	63
400212693116	118	30	80	8	8	102	310	10	10	3111	3	17124	0506	400	63
400212693116	118	30	80	8	8	102	310	10	10	3111	3	17124	0512	400	60
400212693116	118	30	80	8	8	102	310	10	10	3111	3	17124	0805	400	14
400212693116	118	30	80	8	8	102	310	10	10	3111	3	17124	0310	400	55
400312693116	118	30	80	8	8	102	172	2	2	8631	3	17124	0102	400	111
400312693116	118	30	80	8	8	102	172	2	2	8631	3	17124	0301	400	136
400312693116	118	30	80	8	8	102	172	2	2	8631	3	17124	0301	400	109
400312693116	118	30	80	8	8	102	172	2	2	8631	3	17124	0604	400	123
400312693116	118	30	80	8	8	102	172	2	2	8631	3	17124	0208	400	78
400312693116	118	30	80	8	8	102	172	2	2	8631	3	17124	0808	400	66
400412693116	118	30	80	8	8	102	172	2	2	8631	3	17124	0309	400	23
400412693116	118	30	80	8	8	102	172	2	2	8631	3	17124	0301	400	172
400412693116	118	30	80	8	8	102	172	2	2	8631	3	17124	0506	400	89
400412693116	118	30	80	8	8	102	172	2	2	8631	3	17124	0512	400	181
400412693116	118	30	80	8	8	102	172	2	2	8631	3	17124	0805	400	26
400412693116	118	30	80	8	8	102	172	2	2	8631	3	17124	0310	400	61
400512693116	118	30	310	10	10	311	172	2	2	8631	3	17124	0102	400	73
400512693116	118	30	310	10	10	311	172	2	2	8631	3	17124	0301	400	50
400512693116	118	30	310	10	10	311	172	2	2	8631	3	17124	0301	400	77
400512693116	118	30	310	10	10	311	172	2	2	8631	3	17124	0604	400	65
400512693116	118	30	310	10	10	311	172	2	2	8631	3	17124	0208	400	11
400512693116	118	30	310	10	10	311	172	2	2	8631	3	17124	0808	400	29
400612693116	118	30	310	10	10	311	172	2	2	8631	3	17124	0309	400	-10
400612693116	118	30	310	10	10	311	172	2	2	8631	3	17124	0301	400	105
400612693116	118	30	310	10	10	311	172	2	2	8631	3	17124	0506	400	26
400612693116	118	30	310	10	10	311	172	2	2	8631	3	17124	0512	400	133

400612693116	118	30	310	10	10	311	172	2	2	8631	3	17124	0805	400	12
400612693116	118	30	310	10	10	311	172	2	2	8631	3	17124	0310	400	25
460101251118	50	102	90	2	2	15	90	2	2	25 1	2	11144	0311	400	0
460201251118	50	102	90	2	2	15	90	2	2	35 1	2	11144	0311	400	0
460301251118	50	102	90	2	2	15	90	2	2	45 1	2	11144	0311	400	20
460401251118	50	102	90	2	2	25	90	2	2	35 1	2	11144	0311	400	0
460501251118	50	102	90	2	2	25	90	2	2	45 1	2	11144	0311	400	20
460601251118	50	102	90	2	2	351	90	2	2	4511	2	11144	0311	400	20
450101704 14			230000			21130000				3111	2	3144	0108	200	09
450201704 14			230000			21130000				3111	2	11144	0108	200	12
450301704 14			230000			21130000				3111	2	14144	0108	200	38
450401704 14			230000			21130000				3111	2	18144	0108	200	36
3601027331146000	302	720		24	11	720		24	511	2	9133	0309	400	24
3601027331146000	302	720		24	11	720		24	511	2	9133			92
3602027331146000	302	720		24	11	720		24	3011	2	9133	0309	400	42
3602027331146000	302	720		24	11	720		24	3011	2	9133	0309	400	167
3603027331146000	302	720		24	51	720		24	5011	2	9133	0309	400	22
3603027331146000	302	720		24	51	720		24	5011	2	9133	0309	400	76
3604047331146000	302	1440		48	41	720		24	3011	2	9133	0604	400	15
3604047331146000	302	1440		48	41	720		24	3011	2	9133	0203	400	-37
3604047331146000	302	1440		48	41	720		24	3011	2	9133	0706	400	0
3604047331146000	302	1440		48	41	720		24	3011	2	9133	0807	400	24
340104753118	1	11	72	9	9	8	270	9	9	30 1	62	13213	0308	300	-36
340104753118	1	11	72	9	9	8	270	9	9	30 1	62	13213	0308	300	07
340104753118	1	11	72	9	9	8	270	9	9	30 1	62	13213	0301	300	-17
340104753118	1	11	72	9	9	8	270	9	9	30 1	62	13213	0304	300	88
340204753118	1	11	72	9	9	82	900	9	910021		62	13213	0308	300	18
340204753118	1	11	72	9	9	82	900	9	910021		62	13213	0308	300	-27
340204753118	1	11	72	9	9	82	900	9	910021		62	13213	0301	1300	26
340204753118	1	11	72	9	9	82	900	9	910021		62	13213	0304	300	89
340304753118	1	11	270	9	9	30	900	9	910021		62	13213	0308	300	55
340304753118	1	11	270	9	9	30	900	9	910021		62	13213	0308	300	34
340304753118	1	11	270	9	9	30	900	9	910021		62	13213	0301	300	43
340304753118	1	11	270	9	9	30	900	9	910021		62	13213	0304	300	02
230102643117	45	152	71	2	2	353	154	2	2	773	3	1911310100105		300	-24
230102643117	45	152	71	2	2	353	154	2	2	773	3	1911310100804		400	0
230202643117	45	152	154	2	2	773	189	1		11893	3	1911310100105		300	38
230202643117	45	152	154	2	2	773	189	1		11893	3	1911310100804		400	38
230302643117	45	152	71	2	2	353	189	1		11893	3	1911310100105		300	14
230302643117	45	152	71	2	2	353	1[illegible]	1		11893	3	1911310100804		400	38
150101341118	1	12	50	3	3	162		3	3	2121	2	5144	0301	300	16
150201341118	1	12	50	3	3	162	80	3	3	2721	2	5144	0301	300	62
150301341118	1	12	50	3	3	162	90	3	3	3221	2	5144	0301	300	87
150401341118	1	12	50	3	3	162	120	3	3	4321	2	5144	0301	300	104
150501341118	1	12	60	3	3	212	80	3	3	2721	2	5144	0301	300	46
150601341118	1	12	60	3	3	212	90	3	3	3221	2	5144	0301	300	71
150701341118	1	12	60	3	3	212	120	3	3	4321	2	5144	0301	300	87
150801341118	1	12	80	3	3	272	90	3	3	3221	2	5144	0301	300	25
150901341118	1	12	80	3	3	272	120	3	3	4321	2	5144	0301	300	42
151001341118	1	12	90	3	3	322	120	3	3	4321	2	5144	0301	300	17
120101261114	450	362	45	3	3	15	60	3	3	20 1	1	11122	8100306	400	70
120201261114	450	362	60	3	3	20	75	3	3	25 1	1	11122	8100306	400	-15
120301261114	450	362	75	3	3	253	88	3	3	3031	1	11122	8100306	400	28
120401261114	450	362	45	3	3	153	75	3	3	2531	1	11122	8100306	400	61
120501261114	450	362	45	3	3	153	88	3	3	3031	1	11122	8100306	400	74
120601261114	450	362	60	3	3	203	88	3	3	3031	1	11122	8100306	400	13
100111	1146000	352	1200	50	50	242	1850	50	50	3721	13250	9144	0705	300	53
100111	1146000	352	1200	50	50	242	1850	50	50	3721	13250	9144	0705	300	287
100111	1146000	352	1200	50	50	242	1850	50	50	3721	13250	9144	1003	300	134
100111	1146000	352	1200	50	50	242	1850	50	50	3721	13250	9144	0902	400	-17
100111	1146000	352	1200	50	50	242	1850	50	50	3721	13250	9144	0504	400	30
100111	1146000	352	1200	50	50	242	1850	50	50	3721	13250	9144	0510	400	27

```
100211    1146000 352 1200 50 50 242 1850 50 50 3721 13250 9144    0511   400  18
100211    1146000 352 1200 50 50 242 1850 50 50 3721 13250 9144    0201   400 -15
100211    1146000 352 1200 50 50 242 1850 50 50 3721 13250 9144    0206   400 -10
100211    1146000 352 1200 50 50 242 1850 50 50 3721 13250 9144    0209   400  10
100211    114600  352 1200 50 50 242 1850 50 50 3721 13250 9144    0702   400  00
010116672 14600  152 6000300300 202 1938 68 68 2921   250 9144    0301   400 -10
010116672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0305   400  13
010116672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0301   400  28
010116672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0304   400  15
010116672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0304   400  36
010116672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0102   400  25
010216672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0804   400  39
010216672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0803   400  80
010216672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0801   400  28
010216672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0802   400  39
010216672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0208   400  42
010216672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0506   400  54
010316672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0903   400  26
010316672 146000 352 6000300300 202 1938 68 68 2921   250 9144    1001   400 134
010316672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0902   400 104
010316672 146000 352 6000300300 202 1938 68 68 2921   250 9144    0101   400  26
020106553114 240 122   27  1  1 272   39  1  1 39212 250 6144    0501   400  65
020106553114 240 122   27  1  1 272   39  1  1 39212 250 6144    0605   400  28
020106553114 240 122   27  1  1 272   39  1  1 39212 250 6144    0202   400  72
020106553114 240 122   27  1  1 272   39  1  1 39212 250 6144    0202   400  91
020106553114 240 122   27  1  1 272   39  1  1 39212 250 6144    0506   400  66
020106553114 240 122   27  1  1 272   39  1  1 39212 250 6144    0301   400  27
040101432114       2   88  4  4 221  132  4  4 3311  250 8144    1002   300  98
040201432114       2  112  4  4 282  132  4  4 3311  250 8144    1002   300  36
040301432114       2   88  4  4 222  112  4  4 2821  250 8144    1002   300  62
030117724 146000 352  766 40 40 191  980 35 35 28133 25010124    0802   300  66
030117724 146000 352  766 40 40 191  980 35 35 28133 25010124    0803   300  44
030117724 146000 352  766 40 40 191  980 35 35 28133 25010124    0206   300  84
030117724 146000 352  766 40 40 191  980 35 35 28133 25010124    0801   300  43
030117724 146000 352  766 40 40 191  980 35 35 28133 25010124    0207   300  34
030117724 146000 352  766 40 40 191  980 35 35 28133 25010124    0403   300  31
030217724 146000 352  766 40 40 191  980 35 35 28133 25010124    0301   300  47
030217724 146000 352  766 40 40 191  980 35 35 28133 25010124    0602   300  75
030217724 146000 352  766 40 40 191  980 35 35 28133 25010124    0304   300  20
030217724 146000 352  766 40 40 191  980 35 35 28133 25010124    0804   300  20
030217724 146000 352  766 40 40 191  980 35 35 28133 25010124    0805          20
030217724 146000 352  766 40 40 191  980 35 35 28133 25010124    0604          50
030317724 146000 352  766 40 40 191  980 35 35 28133 25010124    0305   300  20
030317724 146000 352  766 40 40 191  980 35 35 28133 25010124    0301   300  56
030317724 146000 352  766 40 40 191  980 35 35 28133 25010124    0304   400  40
030317724 146000 352  766 40 40 191  980 35 35 28133 25010124    0205   400  70
030317724 146000 352  766 40 40 191  980 35 35 28133 25010124    0205   400 115
080101681117  48 162   63  2  2 322  128  2  2 6421   3  20111   0105   300 -24
080201681117  48 162  128  2  2 642  160  1  116031   3  20111   0105   300  38
080301681117  48 162   63  2  2 32   160  1  1160 1   3  20111   0105   300  14
090101541118  48 162  101  4  4 252  394  4  4 99211  35019111   0101   300 326
090201541118  48 162  192  4  4 482  394  4  4 99211  35019111   0101   300 -27
090301541118  48 162  101  4  4 252  192  4  4 48211  35019111   0101   300 353
290101583114150 302 238  7  7 342  294  7  7 4221   2     124    0308   400 000
290201583114150 302 168  7  7 242  294  7  7 4221   2     124    0308   400  12
290301583114150 302 126  7  7 182  294  7  7 4221   2     124    0308   400  06
290401583114150 302 168  7  7 242  238  7  7 3421   2     124    0308   400  54
290501583114150 302 126  7  7 182  238  7  7 3421   2     124    0308   400  13
290601583114150 302 126  7  7 182  168  7  7 2421   2     124    0308   400  00
500101662614       230000       21130000       3111  2 06144    0906   500 -01
500102662614       230000       21130000       3111  2 06144    0306   500  05
500201662614       230000       21130000       3111  2 08144    0906          02
```

| | | |

60010265 1119		2	40	5	5	81	132	22	22	1611	3	17144	0510	300	20
600103691119		2	40	5	5	81	132	22	22	1611	3	17144	0310	300	10
600104691119		2	40	5	5	81	132	22	22	1611	3	17144	0313	300	00
600105691119		2	40	5	5	81	132	22	22	1611	3	17144	0808	300	80
600106691119		2	40	5	5	81	132	22	22	1611	3	17144	0514	300	45
600201691119		2	40	5	5	81	333	9	9	3711	3	17144	0601	300	167
600202691119		2	40	5	5	81	333	9	9	3711	3	17144	0510	300	155
600203691119		2	40	5	5	81	333	9	9	3711	3	17144	0310	300	50
600204691119		2	40	5	5	81	333	9	9	3711	3	17144	0313	300	45
600205691119		2	40	5	5	81	333	9	9	3711	3	17144	0808	300	90
600206691119		2	40	5	5	81	333	9	9	3711	3	17144	0514	300	-35
600301691119		2	132	22	22	161	333	9	9	3711	3	17144	0601	300	102
600302691119		2	132	22	22	161	333	9	9	3711	3	17144	0510	300	135
600303691119		2	132	22	22	161	333	9	9	3711	3	17144	0310	300	40
600304691119		2	132	22	22	161	333	9	9	3711	3	17144	0313	300	45
600305691119		2	132	22	22	161	333	9	9	3711	3	17144	0808	300	10
600306691119		2	132	22	22	161	333	9	9	3711	3	17144	0514	300	80
610101553114		230000				20130000				3011	2	09144	1001	300	36
610102553114		230000				20130000				3011	2	16144	1001	300	18
6201017841246000	352	256	16	16	163	256	16	16	2331	2	10111	0904	300	200	
6201027841246000	352	256	16	16	163	256	16	16	2331	2	10111	0904	300	000	
6201037841246000	352	256	16	16	163	256	16	16	2331	2	10111	0903	300	48	
6201047841246000	352	256	16	16	163	256	16	16	2331	2	10111	0902	300	42	
6201057841246000	352	256	16	16	163	256	16	16	2331	2	10111	0202	300	90	
6201067841246000	352	256	16	16	163	256	16	16	2331	2	10111	0301	300	10	
6201077841246000	352	256	16	16	163	256	16	16	2331	2	10111	0207	300	10	
6201087841246000	352	256	16	16	163	256	16	16	2331	2	10111	0102	300	100	
6201097841246000	352	256	16	16	163	256	16	16	2331	2	10111	0103	300	40	
6202017841246000	352	256	16	16	163	450	15	15	3031	2	10111	0904	300	328	
6202027841246000	352	256	16	16	163	450	15	15	3031	2	10111	0904	300	328	
6202037841246000	352	256	16	16	163	450	15	15	3031	2	10111	0903	300	102	
6202047841246000	352	256	16	16	163	450	15	15	3031	2	10111	0902	300	26	
6202057841246000	352	256	16	16	163	450	15	15	3031	2	10111	0202	300	130	
6202067841246000	352	256	16	16	163	450	15	15	3031	2	10111	0301	300	10	
6202077841246000	352	256	16	16	163	450	15	15	3031	2	10111	0207	300	10	
6202087841246000	352	256	16	16	163	450	15	15	3031	2	10111	0102	300	91	
6202097841246000	352	256	16	16	163	450	15	15	3031	2	10111	0103	300	-09	
6203017841246000	352	256	16	16	163	555	15	15	3731	2	10111	0904	300	328	
6203027841246000	352	256	16	16	163	555	15	15	3731	2	10111	0904	300	328	
6203037841246000	352	256	16	16	163	555	15	15	3731	2	10111	0903	300	112	
6203047841246000	352	256	16	16	163	555	15	15	3731	2	10111	0902	300	31	
6203057841246000	352	256	16	16	163	555	15	15	3731	2	10111	0902	300	180	
6203067841246000	352	256	16	16	163	555	15	15	3731	2	10111	0301	300	10	
6203077841246000	352	256	16	16	163	555	15	15	3731	2	10111	0207	300	10	
6203087841246000	352	256	16	16	163	555	15	15	3731	2	10111	0102	300	95	
6203097841246000	352	256	16	16	163	555	15	15	3731	2	10111	0103	300	53	
6204017841246000	352	368	16	16	233	450	15	15	3031	2	10111	0904	300	164	
6204027841246000	352	368	16	16	233	450	15	15	3031	2	10111	0904	300	328	
6204037841246000	352	368	16	16	233	450	15	15	3031	2	10111	0903	300	54	
6204047841246000	352	368	16	16	233	450	15	15	3031	2	10111	0902	300	-15	
6204057841246000	352	368	16	16	233	450	15	15	3031	2	10111	0202	300	40	
6204067841246000	352	368	16	16	233	450	15	15	3031	2	10111	0301	300	10	
6204077841246000	352	368	16	16	233	450	15	15	3031	2	10111	0207	300	10	
6204087841246000	352	368	16	16	233	450	15	15	3031	2	10111	0102	300	-09	
6204097841246000	352	368	16	16	233	450	15	15	3031	2	10111	0103	300	-49	
6205017841246000	352	256	16	16	233	555	15	15	3731	2	10111	0904	300	164	
6205027841246000	352	256	16	16	233	555	15	15	3731	2	10111	0904	300	328	
6205037841246000	352	256	16	16	233	555	15	15	3731	2	10111	0903	300	54	
6205047841246000	352	256	16	16	233	555	15	15	3731	2	10111	0902	300	-10	
6205057841246000	352	256	16	16	233	555	15	15	3731	2	10111	0202	300	90	
6205067841246000	352	256	16	16	233	555	15	15	3731	2	10111	0301	300	10	
6205077841246000	352	256	16	16	233	555	15	15	3731	2	10111	0207	300	10	

```
6205087841246000 352  256 16 16 233  555 15 15 3731   2  10111   0102   300 -06
6205097841246000 352  256 16 16 233  555 15 15 3731   2  10111   0103   300  14
6206017841246000 352  450 15 15 303  555 15 15 3731   2  10111   0904   300 000
6206027841246000 352  450 15 15 303  555 15 15 3731   2  10111   0904   300 000
6206037841246000 352  450 15 15 303  555 15 15 3731   2  10111   0903   300  09
6206047841246000 352  450 15 15 303  555 15 15 3731   2  10111   0902   300  05
6206057841246000 352  450 15 15 303  555 15 15 3731   2  10111   0202   300  50
6206067841246000 352  450 15 15 303  555 15 15 3731   2  10111   0301   300  10
6206077841246000 352  450 15 15 303  555 15 15 3731   2  10111   0207   300  10
6206087841246000 352  450 15 15 303  555 15 15 3731   2  10111   0102   300  04
6206097841246000 352  450 15 15 303  555 15 15 3731   2  10111   0103   300  63
FINISH
COMMENT          THE FOLLOWING RECODE IS TO CLASSIFY OUTCOMES ACCORDING TO THE FIL
                 BY SMITH SYSTEM WHERE ONE IS STUDENT ATTITUDES. TWO IS INDIVIDUAL
                 IZATION. THREE IS STUDENT PARTICIPATION. FOUR IS ENRICHMENT. FIVE
                 IS CLASSROOM BEHAVIOR. SIX IS INTERPERSONAL REGARD. SEVEN IS OPEN
                 EDUCATION. EIGHT IS QUALITY OF INSTRUCTION. NINE IS TEACHER ATTIT
                 UDE. TEN IS SCHOOL CLIMATE.
RECODE           V33 (0101 THRU 0109=1)(0201 THRU 0209=2)(0301 THRU 0312=3)(0401
                 THRU 0406=4)(0501 THRU 0512=5)(0601 THRU 0605=6)(0701 THRU 0705=7
                 )(0801 THRU 0810=8)(0901 THRU 0907=9)(1001 THRU 1003=10)
                 V33 (0101)STUDENT ATTITUDE TOWARD TEACHERS (0102)ST ATTITUDE TOWA
                 RD SCHOOL OR CLASS (0103)ST. SELF CONCEPT (0104)ST MENTAL HEALTH
                 (0105)ST ATTITUDE TOWARD EDUCATIONAL PROGRAM (0106)ST. MOTIVATION
                 (0107)ST. PREFERENCES FOR CLASS SIZE (0108)ST ATTITUDE TOWARD
                 LIFE (0201)TEACHER KNOWLEDGE OF PUPILS (0202)AMOUNT OF INDIVIDUAL
                 TEACHER STUDENT INTERACTION (0203)NUMBER OR VARIETY OF ACTIVITIES
                 (0204)AMOUNT OF SEATWORK OR STUDENTS WORKING ON INDIVIDUAL TASKS
                 (0205)AMOUNT OF WORK IN SMALL GROUPS (0206)TEACHER ATTENTION TO I
                 INDIVIDUAL STUDENTS (0207)ADAPTATION OF TEACHING TO INDIVIDUALS
                 (0208)BUILDING FOUNDATION FOR INDEPENDENT WORK (0209)CONFERENCES
                 WITH PARENTS (0301)STUDENT PARTICIAPATION IN DISCUSSIONS OR LESSO
                 N(0202)AMOUNT OF INDIVIDUAL TEACHER STUDENT INTERACTION (0303
                 AMOUNT OF WORK IN SMALL GROUPS (0304)GENERATION OF AND RESONSE TO
                 QUESTIONS (0305)INTEREST AND ENTHUSIASM FOR CLASSWORK (0206)
                 ATTENDANCE (0207)STUDY HABITS (0308)TEACHER DIRECTEDNESS(-)(0309)
                 STUDENT ENGAGEMENT (0310)DIFFICULTY IN LEARNING (0311)ATTENTION
                 (0312)ON-TASK BEHAVIOR (0401)CREATIVE ACTIVITIES (0402)DRAMATICS
                 (0403)DIVERGENT THINKING (0404)USE OF MANIPULATIVE MATERIALS (050
                 1)AGGRESSION (0502)OFFTASK BEHAVIOR (0503)APATHY (0504)FRICTION (
                 (0505)DIFFICULTY (0506)DISCIPLINE (0507)DEPENDENCE (0508)ANXIETY
                 (0509)AMOUNT OF TEACHER CONTROL (0510)POSITIVE TEACHER CONTROL
                 (0511)GOOD STUDENT BEHAVIOR (0512)FRUSTRATION (0513)CHARACTER
                 DEVELOPMENT (0601)PEER GROUP LINKS (0602)STUDENT SOCIAL INTERACTI
                 ON (0603)COHESIVENESS (0604)FRIENDLY TEACHER STUDENT RELATIONSHIP
                 (0605)SOCIOMETRIC CHOICE (0701)FREEDOM OF MOVEMENT IN THE CLASSRO
                 OM (0702)STUDENT CHOICE OF ACTIVITIES (0703)INFORMALITY (0704)SOC
                 IAL INTERACTION (0705 GOAL DIRECTION(-) (0(0801)CREATIVE INSTRUC-
                 TION (0802)USE OF TEACHING AIDS (0803)TEACHER ORGANIZATION AND
                 PLANNING (0804)GENERAL QUALITY (0805)AMOUNT OF MATERIAL COVERED
                 (0806)TASK STRUCTURI NG (0807)POSITIVE EVALUATION (0808)VARIED LE
                 ARNING ACTIVITIES (0809)INNOVATION (0901)TEACHER MORALE (0902)TEA
                 CHER ATTITUDE TOWARD STUDENTS (0903)TEACHER PERCEPTIONS AND SATIS
                 FACTION (0904)EXPECTATIONS FOR PERFORMANCE (0905)WORKLOAD (0906)A
                 ABSENCES (0907)TEACHERCHER PROFESSIONAL GROWTH (1001GENERAL SCHOO
                 L CLIMATE (1002)INNOVATIONS AND ADAPTATIONS IN THE SCHOOL (1003)U
                 USE OF SPACE IN SCHOOL/
```